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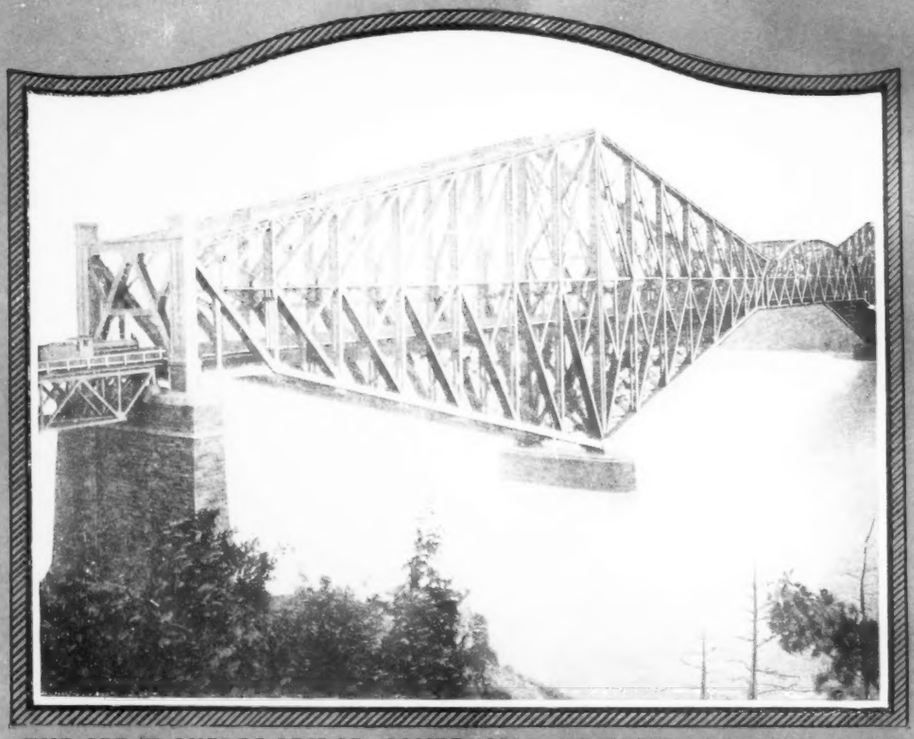

THE GREAT QUEBEC BRIDGE. COMPRESSED AIR HELPED TO BUILD IT AND NOW HELPS TO MAINTAIN IT.

Quarries and Quarry Products
N. S. Greensfelder

Oil-Engine Tug Put Through Paces
P. A. Sensenig

Story of the Portland Gold Mine
C. H. Vivian

Roadbuilding in Isolated Region
R. G. Skerrett

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A Repeat Order Explained

The Chicago & North Western Railway bought its second Oil-Electric Locomotive almost immediately after the delivery of the first one. Nor is the reason hard to understand.

Officials of the road made a statement to The Wall Street Journal. We quote from the issue of October 18:

> "An Oil-Electric Locomotive in use for more than five months on the Chicago & North Western Railway system *has shown a saving* of practically 50% in operating and maintenance expense over a steam locomotive engaged in the same work. . . . In addition, the Oil-Electric Locomotive has actually done *twice the daily work* of the coal-burner.
>
> "The operating and maintenance cost of the Oil-Electric, according to the Chicago & North Western Officials, has averaged $44.00 a day, while that of a comparable type of steam locomotive, doing the same job, is $82.00. This embraces fuel, lubricating oil, wages, and roundhouse expense."

Built Jointly by

General Electric Company
American Locomotive Company
Ingersoll-Rand Company

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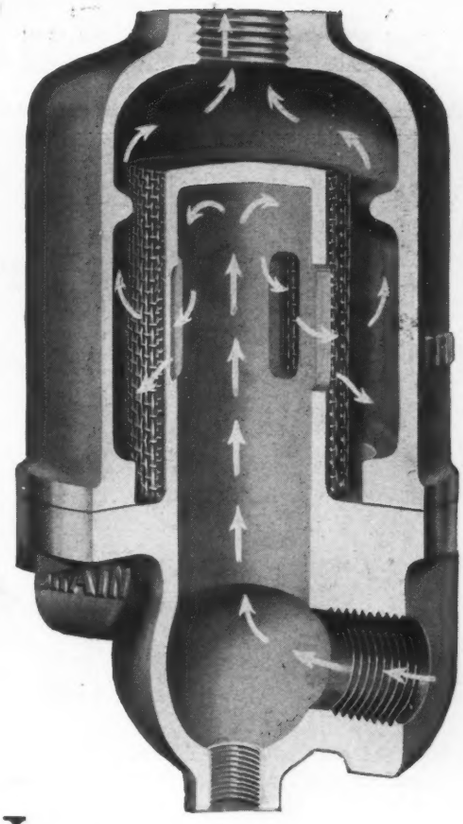

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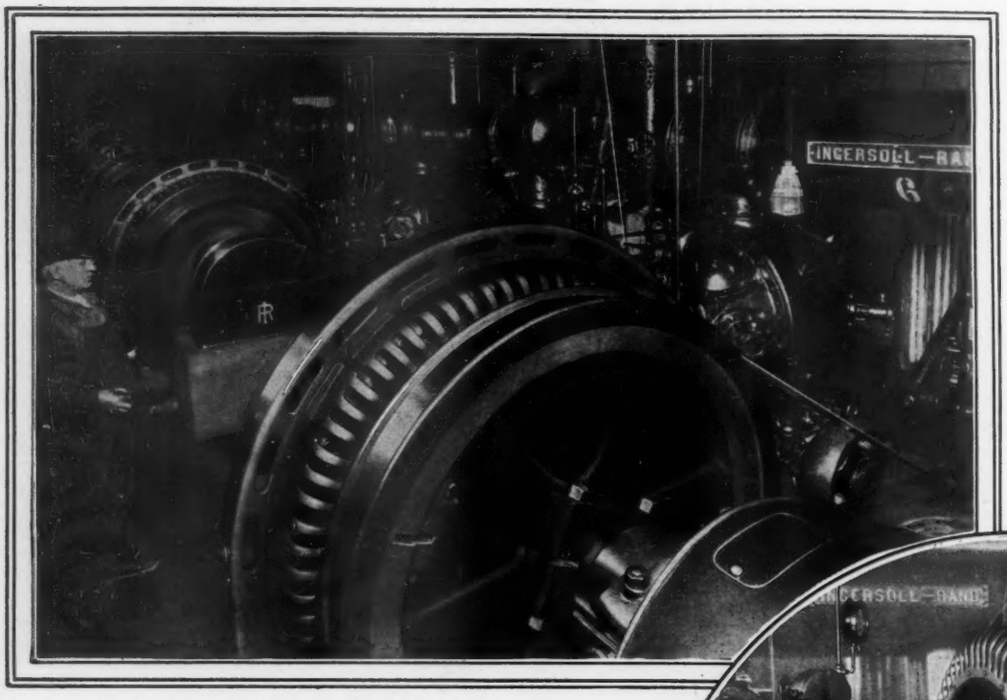
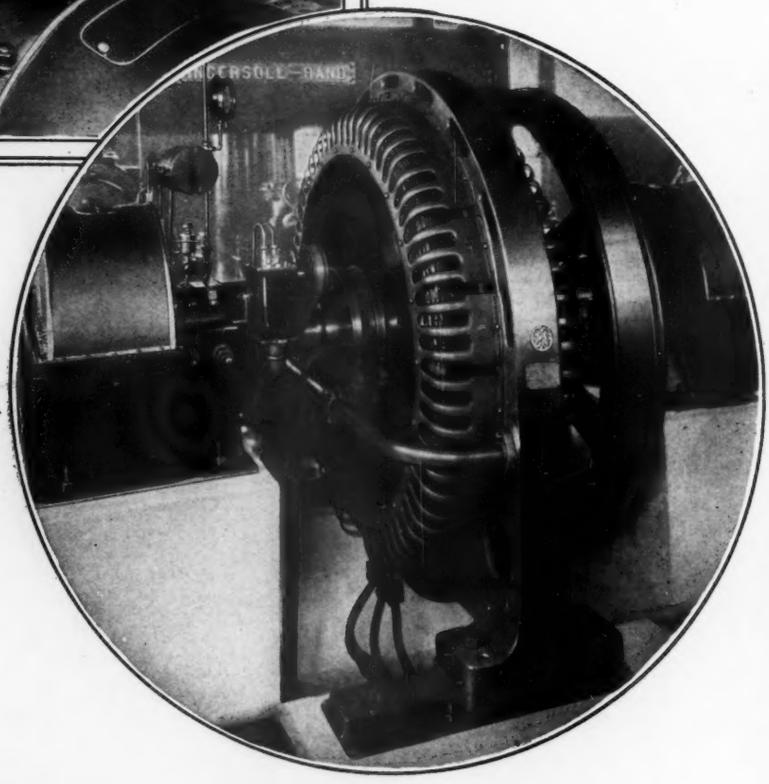


Six 300 h.p. G-E Synchronous Motors with G-E Controllers operating the air compressors on the contract of Rodgers & Hagerty at St. Nicholas—Broadway—160th to 173rd Sts.



G-E 225 h.p. Synchronous Motor on the contract of F. L. Cranford.

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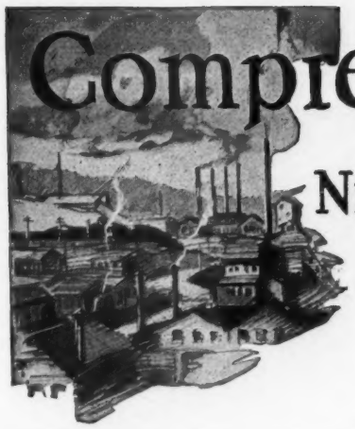

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JANUARY, 1927

Rapid Roadbuilding In Isolated Region

An Oil-Engine Prime Mover Has Enabled the Contractor to Do His Work Well and Economically

By ROBERT G. SKERRETT

ABOUT 50 miles from Scranton, in the heart of the wild and picturesque hills of Pike County, in eastern Pennsylvania, the Keystone State has a section of the Roosevelt Highway under reconstruction so that the motorist will find travel safer and easier through this region of great natural beauty. The story that we have to tell here has to do with work on an 11-mile stretch of this route that is yearly becoming more popular with the sightseeing tourist.

So much has been done to facilitate motor traffic the country over that the average pleasure-seeking driver gives little if any thought to the conditions, to the physical difficulties that have to be mastered in making some of these roads possible—especially in rugged or mountainous regions of the land. Therefore, it is fitting that we describe in a general way what Pennsylvania is doing along this particular part of the Roosevelt Highway through the collaborating efforts of David Schoentag, Inc., the capable and energetic contractor who has this work immediately in hand.

The roadbed is of the type technically known as waterbound macadam, upon which the state will place a surface of tar. Macadam roads call for the use of much stone; and in the present case the 11-mile section will require, all told, fully 36,000 cubic yards of stone. This will be readily understandable when the reader is reminded that the roadbed will be composed of two courses of heavy stone, and that the pavement between the flanking shoulders—each 5 feet wide—will have a width of 18 feet. Manifestly, one of the biggest problems calling for solution by the contractor was the determining of ways and means by which the needful stone could be obtained at some point close to the field of operations so as to avoid hauling material considerable distances over a rugged country with frequent heavy grades. Incidentally, let it be remarked that the nearest railroad station lies fully 7 miles from any part of the job.

WE shall soon have in the United States a total of half a million miles of surfaced roads forming a network of highways over the length and breadth of the land. The building of these arteries of vehicular intercommunication tells as nothing else, perhaps, does tell how radically the motor car and the motor truck have altered the social and the industrial meanings of our highways.

The construction of modern roads capable of withstanding the pounding blows of speeding pleasure cars and heavily laden motor trucks is an art that is still somewhat in a state of flux. But an outstanding feature of all this important work is that these highways call for the use of materials and facilities that must be placed at the disposal of the roadbuilder whether his job be within easy reach of a base of supplies or situated in the heart of a wilderness.

The present article is, therefore, of value because it tells how one enterprising and experienced contractor is able to carry his work forward rapidly in an isolated mountain region largely because he is using a heavy-oil engine as his primary source of power.

After careful consideration, the contractor decided against the employment of a steam-power plant or of purchased power to drive the crushers and to operate the stationary compressors that provide air for the rock drills at the quarry, which he elected to open up at a strategic point along the road under reconstruction. The use of steam would have necessitated the hauling of coal from the remote railway station and would have involved, besides, the daily transportation of anywhere from 4,000 to 5,000 gallons of water from the nearest source of supply, some distance away. He therefore wisely decided to install as a prime mover a 100-H.P., "PO" oil engine—this engine being direct connected with a 12x10-inch, Class "ER-1" compressor and connected through a line shaft with the crushers by means of a single-disk, cut-off coupling. This arrangement makes it possible to uncouple the engine from the line shaft when the crushers are not operating or when it is necessary only to drive the compressor to furnish air to the blacksmith shop and to the rock drills at the quarry.

Before describing the means employed by the contractor to get out rock and to prepare it for use on the road, it may be well to make clear just what is meant by the term waterbound macadam. In the present case the roadbed is formed by successively spreading and rolling two courses of heavy stone—each course being covered with rock dust and rolled by 15-ton, gasoline-driven rollers. On completing the upper course of stone, water is sprayed upon the rock dust; and the action of the rollers tends to grind the mixture until it becomes a cement-like grout. This grout, when dry, serves effectually to bind the broken stone into a solid mass—the grout penetrating the crevices. Four gasoline rollers are employed on the job; and

Left—"Jackhamers" are used to block hole the large pieces of rock.
Right—The No. 50 "Leyner" sharpener, in the blacksmith shop, which takes care of all the steels used in the quarry.

when constructed and finished in the manner described only the final surfacing with tar or bitumen will be required to produce a first-class and durable roadway.

In addition to forming the waterbound macadam roadbed, the contractor must first regrade the original road which was built with a crown of 16 inches. It is necessary for him to reduce this crown to 7⅛ inches—using the earth removed in this process to form the shoulders of the new road. The grading is being done with two Best tractors drawing Adams graders of the leaning-wheel type, and with one Austin Western heavy-duty caterpillar grader. With the regrading of the subgrade completed, the construction of the waterbound macadam roadbed is begun. It may be of interest to mention at this point that David Schoentag, Inc., is pushing forward at a rate which permits the finishing of one mile of road a week during favorable weather. This performance is directly due to skillful organization, to the use of efficient mechanical facilities, and to the operating of the quarry and the crushers in a manner that would be deemed highly creditable to any concern engaged only in the commercial production of crushed stone.

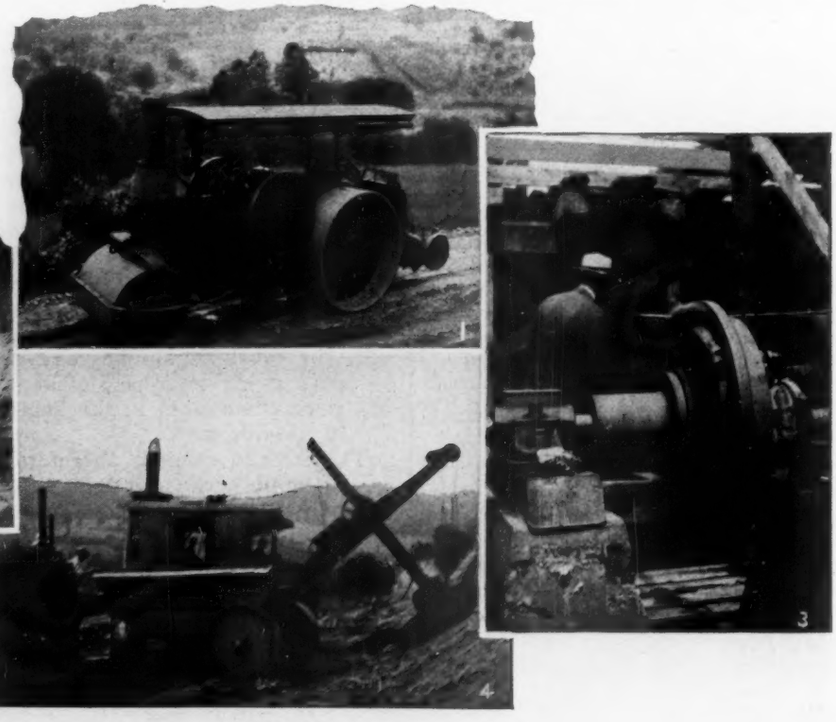
Inasmuch as stone plays so important a part in the successful execution of the contract we are warranted in dealing in some detail with the procedure followed at the quarry and at the nearby and conveniently located crushing plant. The rock is a very hard-grade sandstone; and

Fig. 1—Heavy 15-ton rollers are used to solidify the two courses of rock that form the roadbed.

Fig. 2—The power-driven tractor works with ease where horses would be severely hampered or possibly halted.

Fig. 3—The coupling by which the oil engine and the crushing plant are connected or disconnected.

Fig. 4—Some of the equipment used by the contractor to speed up his work.



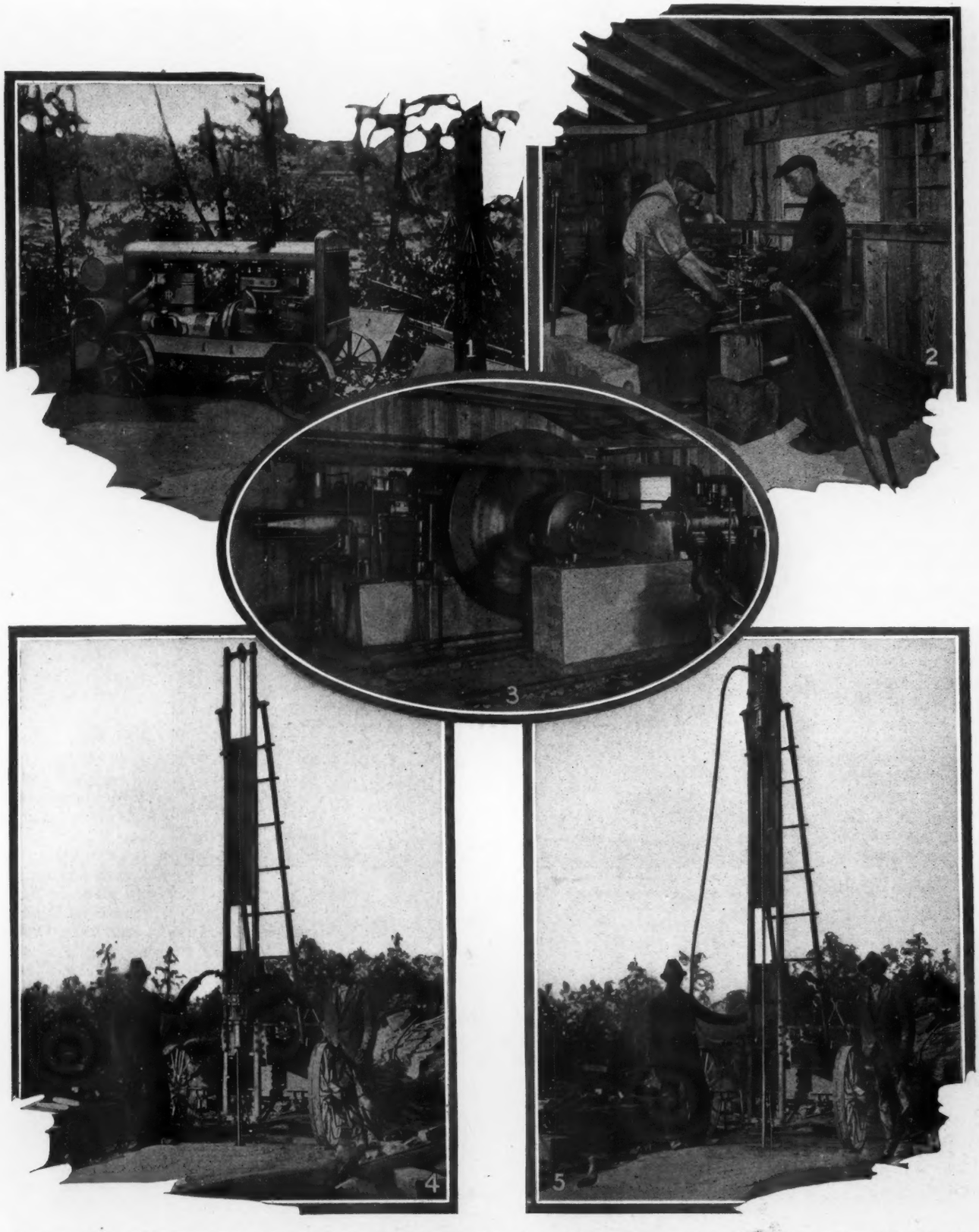


Fig. 1—This portable compressor furnishes air for the blacksmith shop and the quarry when the stationary compressor is idle for any reason.

Fig. 2—"Leyner" sharpener being used as an extemporized press to hold an air drill in preparing steelwork for the crusher plant.

Fig. 3—The prime mover on the job is a "PO" heavy-oil engine of 100 B.H.P.

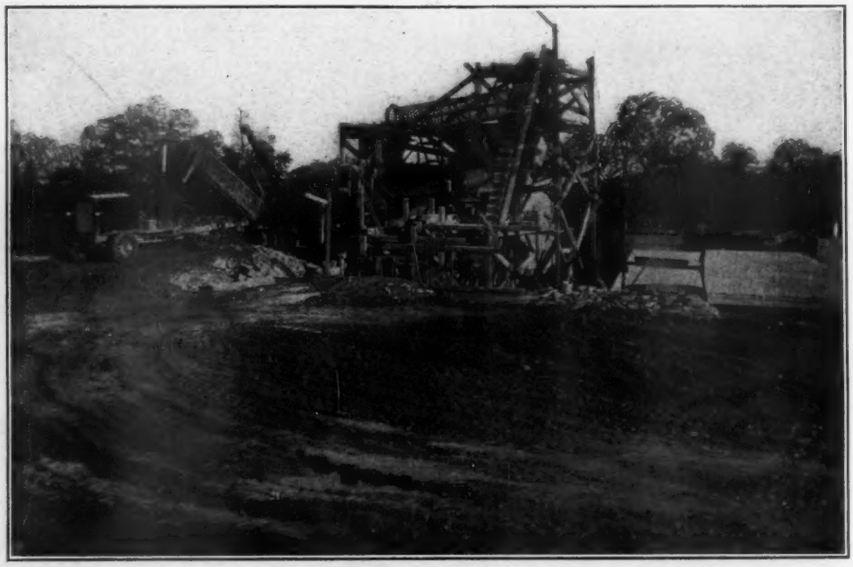
Fig. 4—The X-70 drill lowered and with the drill bit in contact with the rock ready to begin work.

Fig. 5—The X-70 drill, raised by the "Utility" hoist, withdrawing a long drill steel.

the outcropping is generally overlain by a comparatively shallow deposit of earth which is easily stripped because of the horizontal disposition of the ledge. In fact, the disposition of the ledge lends itself admirably to the employment of a wagon-drill, which has been used for the most part in drilling the 12-foot vertical holes. Where it is not practicable to bring the wagon-drill into position for work, the contractor has recourse to a tripod-mounted "X-70" drill in driving his deep blast holes. With the wagon-drill, and starting with a 2½-inch bit and dropping ¼ of an inch each time the steel is changed, he obtains a footage of 300 feet a day—making a 4-foot run with each steel.

The hard rock offers no particular difficulties except that it is rather abrasive and, therefore, reduces rather quickly the effective gage of the bits. With the "X-70" drill, when tripod mounted, the contractor makes an average footage of 150 feet a day. DCR and BCR "Jackhamers" are used to block hole the largest of the pieces of blasted rock; but a considerable quantity of the seamy rock is broken up with a "CC-35" paving breaker—thus lessening the amount of block holing that would otherwise have to be done. We might add here that the wagon-drill is equipped with a "Utility" hoist, which is used to pull the steels. Work at the quarry is so well organized that the contractor is able to get out anywhere from 60 to 70 tons of rock an hour. Inasmuch as the working day is of 12 hours, this means an output of from 720 to 840 tons in the course of a shift!

The stone is compacted by 15-ton power-driven rollers.



The crusher plant is capable of handling from 60 to 70 tons of rock hourly.

Rock is loaded at the quarry by a Northwest 1¼-yard gasoline-driven shovel; and the rock is hauled from the quarry to the crushing plant by two Linn tractors. At the crushing plant the rock is dumped into a chute and fed thence by belt conveyors to the crushers. The crushing equipment consists of two No. 6 and one No. 3 Champion crushers and of one set of New Holland rolls. The New Holland rolls serve to make rock dust. The tailings—that is, the oversize stone that cannot pass through the largest holes in the revolving screens—are returned by the chute to the No. 3 crusher, after which the stone reënters the screens. The largest size of stone acceptable for use in roadbuilding must pass through a 4-inch ring. Chips that will go through screen holes ranging from ⅝ inch to 1¼ inches constitute the material that is fed to the New Holland rolls to produce the needful rock dust.

Laying one of the courses of heavy stone in reconstructing the Roosevelt Highway.

Inasmuch as the "PO" 100-H.P. oil engine must, at times, drive all the crushing machinery as well as the 12x10-inch Ingersoll-Rand compressor, it should be manifest that that prime mover is on occasions carrying a very heavy load—especially when the crushing plant is called upon to handle from 720 to 840 tons of rock a day. Incidentally, it should be mentioned that starting air for the oil engine is provided by a Type 15 compressor driven by a 6-H.P. Novo gasoline engine. The air supply required for operating the No. 50 "Leyner" sharpener and the forge in the blacksmith shop, as well as for driving the drills in the quarry, is not obtained entirely from the 12x10-

inch compressor. The contractor has provided a 10x8-inch I-R portable which, together with the stationary compressor, delivers air to a common receiver. Thus, when the oil engine is not running, or when the demand for air is very heavy, the portable either takes care of the need or supplements the output of the oil-engine-driven unit. By this arrangement the contractor assures himself an ample supply of compressed air to meet any working condition. The oil engine requires 60 gallons of fuel daily for a 12-hour run. This oil costs 8⅓ cents a gallon delivered on the job. Circulating water for the engine is transported to the power plant from a source of supply two miles away; and the daily evaporative loss which must be made good averages about 200 gallons.

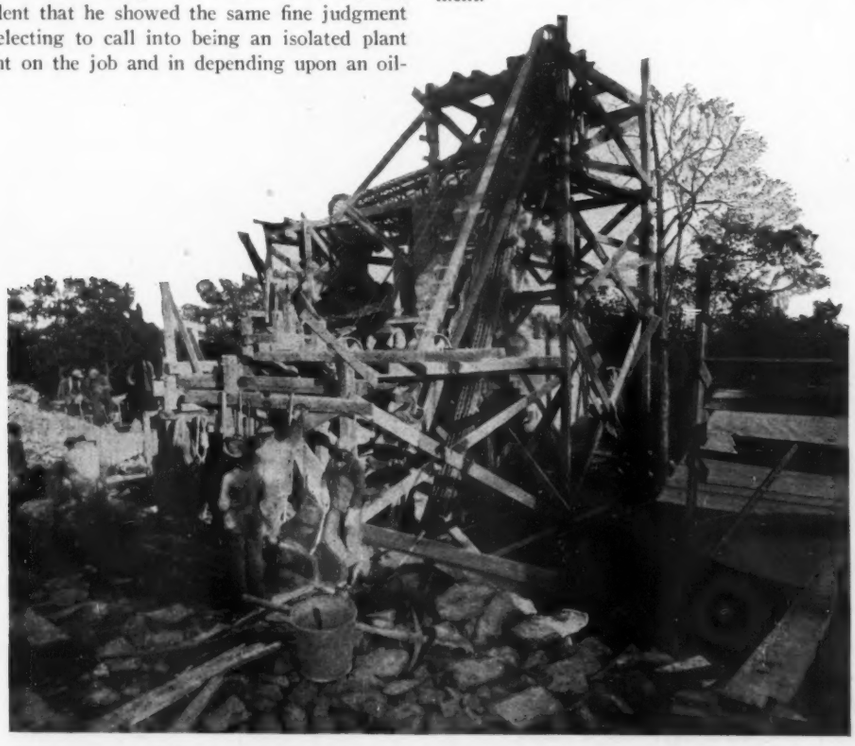
To facilitate the carrying on of work at the quarry and at the crushers when the days are short or the light is dim, the contractor has provided a Delco plant which furnishes the needful current for electric light. This has proved well worth the outlay, because it insures maintaining effective operations during the full working of 12 hours, day in and day out.

The equipment used to haul stone from the bins to all parts of the road under reconstruction is made up of four 5-ton Mack trucks and of four 5-ton Auto-Cars. It is because the contractor has put dependence so largely upon mechanical aids of one sort or another that he is able to accomplish all he does with a working force of only 100 men.

As already mentioned, this section of the Roosevelt Highway crosses semi-mountainous and rugged country. The steepest slopes have a gradient of 8 per cent., and there are numerous climbs of this sort. It should be manifest, therefore, that the contractor has done wisely in choosing the facilities that he employs in pushing the work along. It should also be equally evident that he showed the same fine judgment in electing to call into being an isolated plant right on the job and in depending upon an oil-driven prime mover as a source of power. A steam plant capable of meeting existing conditions would have to be of quite 125 H.P.; and a plant of that description would consume between 3½ and 4 tons of coal a day. Coal delivered on the job would cost not less than $5 a ton; and it would be necessary to have the services of a fireman to take care of the boiler.

Work on the contract was started on September 15 of the year just closed; and the contractor expects to complete the job in the course of a couple of months this spring. The contract price for regrading the subgrade and for constructing the new waterbound macadam roadbed is $170,000. The undertaking is an interesting example of what can now be done by a capable contractor employing up-to-date equipment.

General view of the quarry from which the contractor is obtaining the stone he needs.



The crusher plant which is driven by the oil engine.

NEW PAINT SPRAY

THE increasing popularity of spray painting has led to the production of numerous outfits and nozzles designed to do the work economically and with dispatch. A new paint spray has just been put on the market that is said to be light in weight, compact, and so constructed that it has no moving parts to get out of order and no passages that are likely to clog.

When in operation, the paint enters a large annular chamber surrounding the air nozzle, from which it is blown by means of air pressure and expanded in going through a Venturi-shaped passage. Atomization is regulated by turning the nozzle, itself; and the size of the spray can be adjusted to suit requirements—ranging all the way from a small to a large spray. When the nozzle is turned off, it is also possible to bring into play a stream of compressed air for cleaning purposes. Air at a pressure of 40 pounds is ordinarily used, but the pressure can be varied, if desirable.

PHENOL IMPROVES FUEL OIL FOR DIESEL ENGINE USE

CONTINUOUS experiments over an extended period with a 500-H. P. Diesel engine have demonstrated that fuels rich in phenol and similar compounds produce beneficial results. On this subject, Mr. A. Spilker, in *Brennstoff-Chemie,* says: "Although the phenols contain more oxygen than the ordinary hydro-carbon oils and although the thermal efficiency of the engines is therefore reduced, they cause much cleaner combustion to take place. Corrosion, especially of the piston rings and cylinder liners is reduced, while the standard compression of the engine is therefore maintained for longer periods of time without resetting. Lubricating conditions, the author also maintains, are improved because of the reduced tendency towards the formation of gummy and tarry residues. If these results are confirmed, it would seem as though undesirable fuels could be rendered fit for Diesel engine use by the simple process of adding the required amounts of phenol compounds."

CHANGES WROUGHT IN THE APPEARANCE OF NEW YORK CITY IN A QUARTER-CENTURY

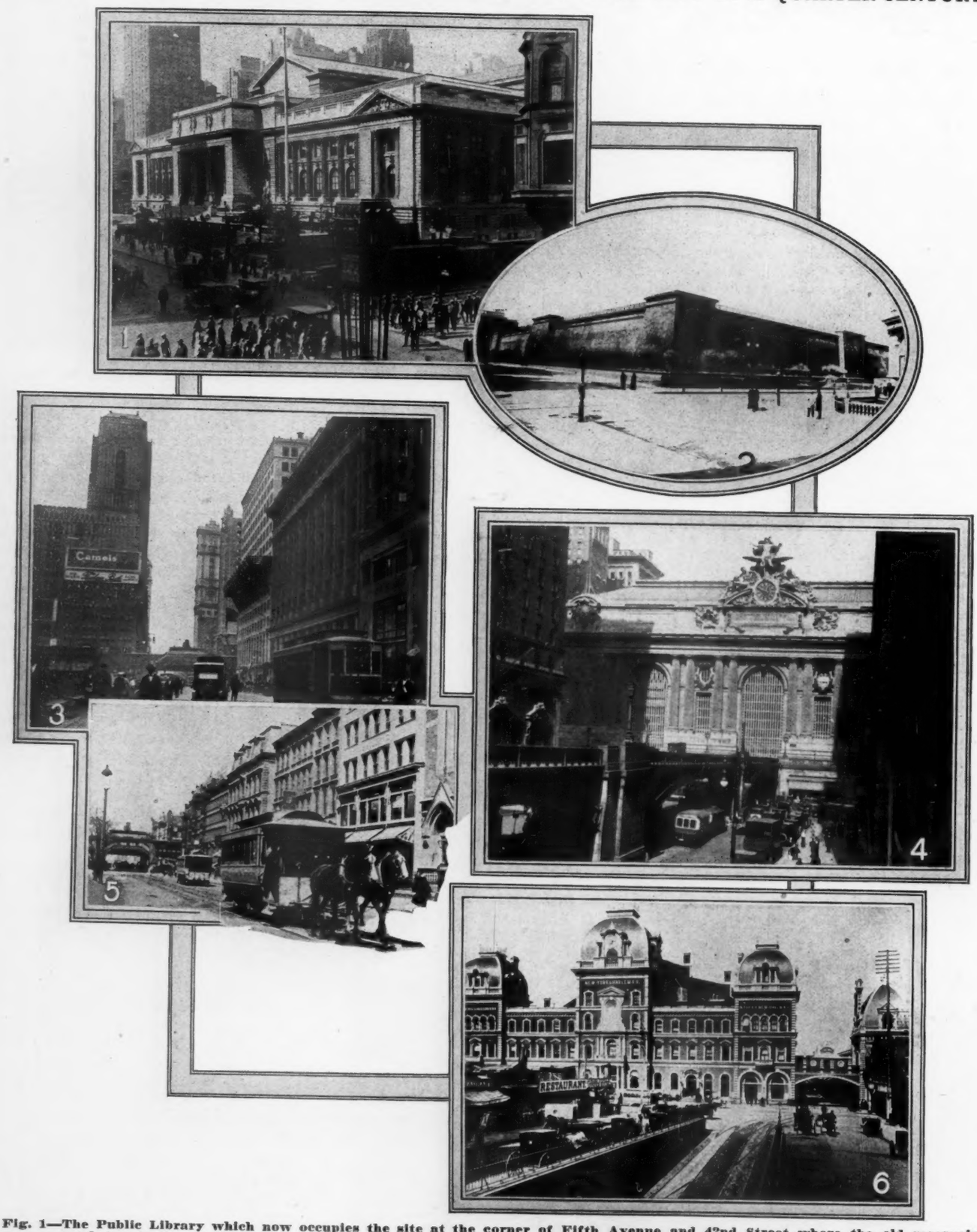


Fig. 1—The Public Library which now occupies the site at the corner of Fifth Avenue and 42nd Street where the old reservoir used to stand.
Fig. 2—How the busiest corner in the world, at the intersection of Fifth Avenue and 42nd Street, appeared in 1898 when the old reservoir was still standing.
Fig. 3—Looking west toward the Sixth Avenue Elevated on 42nd Street as it appears today while still undergoing radical architectural transformations.
Fig. 4—A part of the southern facade of the Grand Central Terminal of today.
Fig. 5—How 42nd Street looked in 1899, when horse-drawn street cars were in use.
Fig. 6—The "Gateway" of New York, as the Grand Central Terminal was called in its prime in 1898.

Jerry And His Alaskan Dog Team

How Mail and Reading Matter Were Brought to a Snow-bound Camp to Relieve the Monotony of the Workers

By THE STAFF

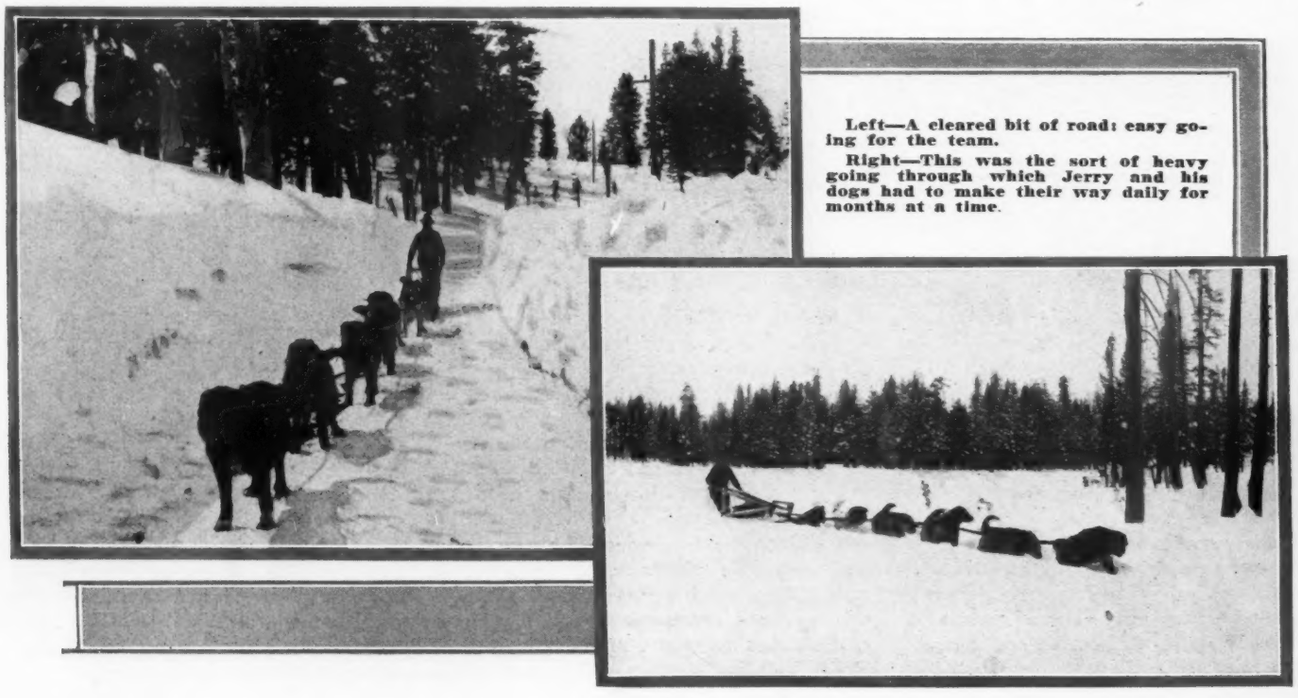
"GO the limit on service," is the keynote of America's oldest company engaged in the manufacture of rock drills, air compressors, etc., now so extensively employed in many fields of industry and engineering work. It was this spirit of service—even unusual service—that was instantly responsive when the chief engineer of the Southern California Edison Company called up the Los Angeles office of the manufacturer in question and asked the manager if he could furnish any information about how and where a dog team could be obtained. The team was wanted to maintain contact between a post office at rail head and construction camps isolated in the snow-clad Sierras.

The manager in Los Angeles telegraphed to his company's Juneau office, and at once steps were taken to purchase a dog team and to secure the services of its owner, one Jerry Dwyer. The dogs and their driver were promptly shipped south and landed in Seattle, where the local office of the mining-machinery manufacturer arranged with a veterinary to inspect the dogs and to have them passed into the country. With this done, the dogs were reshipped to San Francisco, where a member of the San Francisco office of the Ingersoll-Rand Company with representatives of the Southern California Edison Company met the boat and started the team and their driver overland to the scene of the Big Creek hydro-electric job.

Jerry Dwyer and one of his sturdy huskies.

Before we tell the story of what Jerry Dwyer and his dogs did, let it be recalled that each year, while the excavation of the 13½-mile Florence tunnel on the Big Creek project was underway, there were days running when snowstorms raged and ordinary means of transportation were halted. It was to fill this breach in the line of communication that the dog team was brought south from Alaska. Despite the heavy going and the hampering snow, Jerry's dogs were able to draw a load of 200 pounds of first-class mail over the snow and ice; and they did this on several occasions when it was otherwise impossible to move those much-desired bags.

We are indebted to *Edison Partners* for the following story: "In 1920, when the necessity was evident for completing the Florence Lake Tunnel at the earliest possible moment—so that the run-off of the watersheds tributary to the upper San Joaquin River might be conserved for electrical generation and lateral irrigation of the valleys, the Edison Company decided to open winter camps far back in the snow country beyond the reach of wheels. Men had to give themselves up to voluntary exile for months, without means of communication with the outside world of which they must take leave. That these brave men might not be entirely cut off from their dear ones, from newspapers, and books, the Edison Company sent to Alaska and employed Jerry Dwyer, an old 'sourdough of the Klondike,' and bought his team and sled. He brought with him seven trained team dogs, of which the leader, Babe, died. The others survived. They were Patsy,



Left—A cleared bit of road: easy going for the team.

Right—This was the sort of heavy going through which Jerry and his dogs had to make their way daily for months at a time.

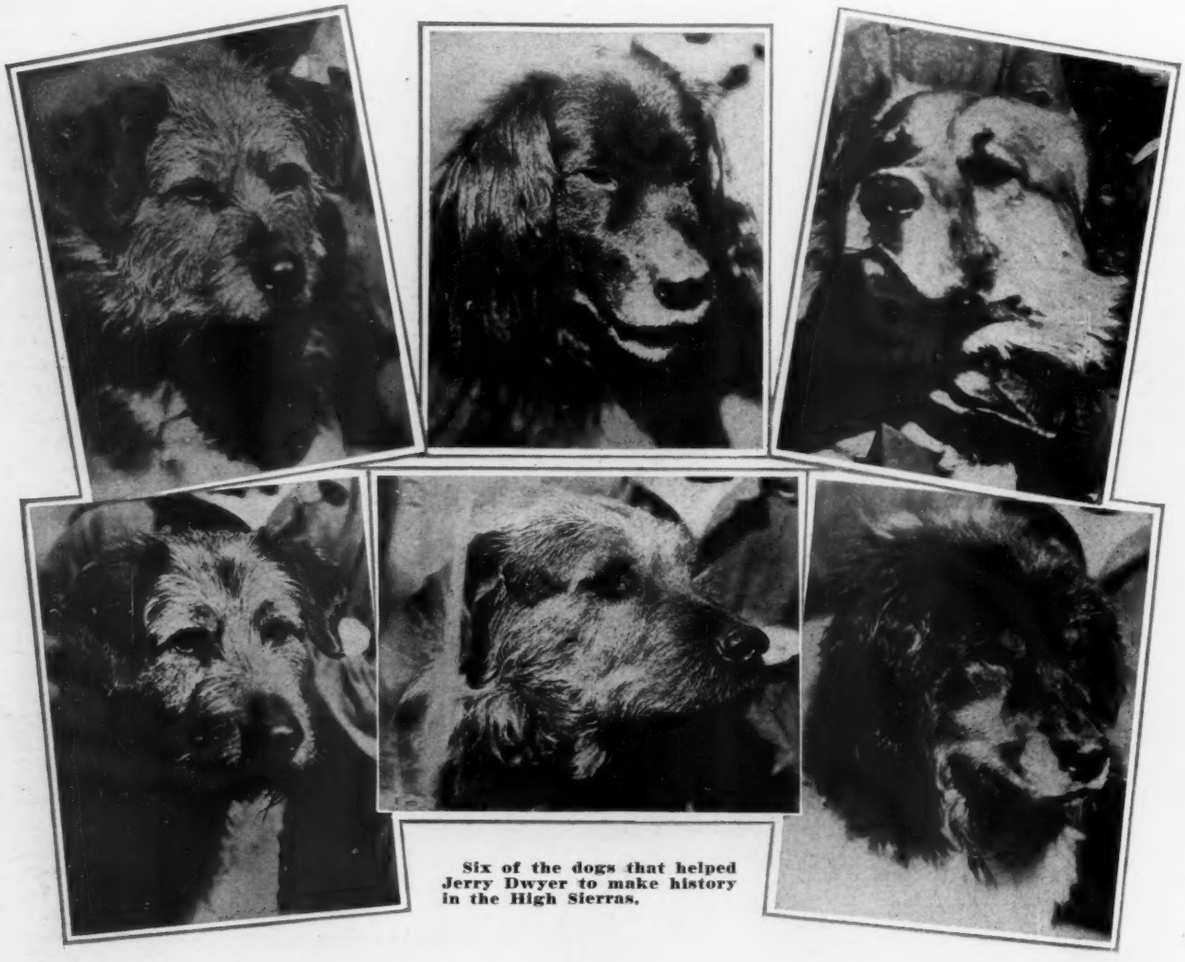
who succeeded Babe as leader—a cross between a Malamute and a Gordon setter; Dooley, a cross between a Malamute and a shepherd; Riley, one-half wolf and one-half St. Bernard; and Barney, Whiskey, and Trim, who were crosses between staghound, wolf, and Airedale. Babe, the dead leader was three-quarters wolf, bred from a wolf and a native Alaskan dog generally called 'Siwash.'

"What happened that made Jeremiah Dwyer the driver of a dog team in Alaska and in the High Sierras? Reporters, editors, magazine writers, and psychologists often asked him; but with some anecdote about Babe or Whiskey or Riley, he smilingly turned the probe aside that would have penetrated his life story, and the probers ceased their probing as they winced before the unspoken rebuke in the patient blue eyes with a life secret somewhere behind them.

"Jerry Dwyer typifies the strong man in middle life with a lithe, alert, and closely knit figure—his tread being that of the mountaineer; and he has shown a capacity for unbelievable endurance. His face is fine and kindly, with a broad forehead; and about his firm mouth are written deep lines which trace the story of mental and bodily conflict. Save when talking about his dogs, Jerry has been as silent as the Great White North from whence he came."

During the winter of 1921-22, Jerry made his toilsome trip daily for 158 days. On each trip his dog sled carried books from the Fresno Public Library to the men in the isolated camps, who spent much of their spare time reading. During the winter of 1922-23, Jerry's task was doubled, because another camp was opened far beyond Kaiser Pass and almost at the shore of Florence Lake, where drilling on the intake portal of the tunnel was begun.

Someone has suggested that Babe, the wolf dog, alone had shared the secret of Jerry Dwyer's life—and understood. Whether that is true, still there was no question about the bond of affection that had linked the two when Babe was alive. Again, let us quote from *Edison Partners.* "Where the roadway gouges through the massive rocks on the crest of Kaiser Range there stands a cross, and upon it is inscribed the word 'Babe.' If, on the second day of some September you should be standing hard by, you would see a man clambering up the acclivities and lay a bunch of wild flowers at the foot of the cross. That man would be Jerry Dwyer, the driver of the Edison Alaskan dog team which, for several winters, made daily trips hauling a sledge-load of mail from the Big Creek Post Office to the marooned tunnel workers in the Edison snowbound camps nestled between the ranges of Kaiser and the Minarets. They broke their way through snowdrifts from 20 to 30 feet deep, and they faced blizzards worse than any that ever swept the Yukon. The grave is the grave of Babe, the wolf dog, who for two years led the team and guided it over the glistening snow while Jerry on snowshoes, held the handle of the sled and called in the dialect of the French Canadian, 'Mush! Mush! Mush!'"



Six of the dogs that helped Jerry Dwyer to make history in the High Sierras.

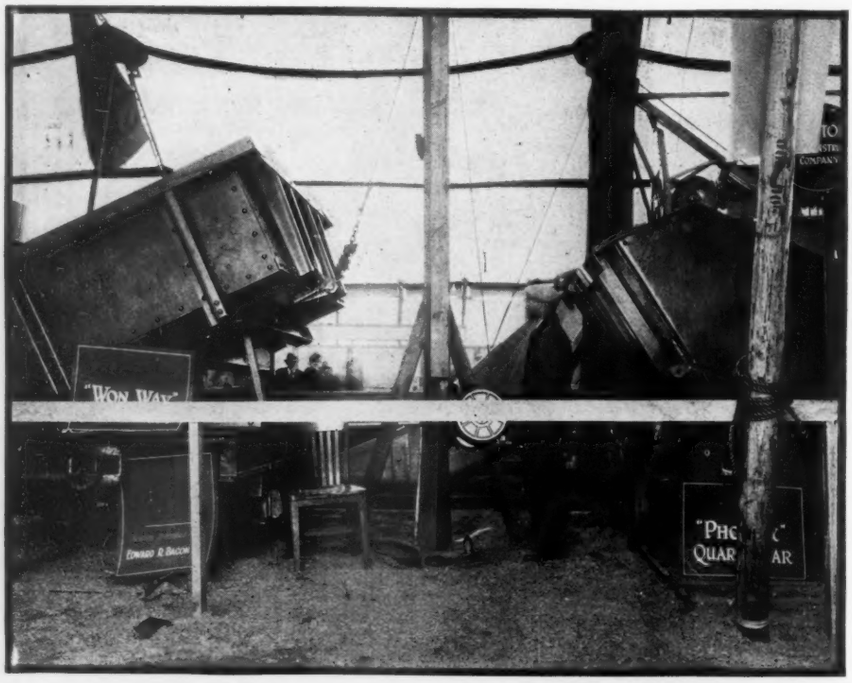
USE OF AIR REGULATOR SAVES POWER

A DEVICE for controlling the flow of air to sand-blast machines has recently been put on the market by the Fisher Governor Company. This regulator comes in 1- and 2-inch sizes, and consists of a strainer and of a reducing valve coupled together so closely that only a few inches of pipe line is necessary.

In the average plant, air used in sand-blast departments is taken from the same compressor that supplies other departments with air, generally at a pressure of 100 pounds per square inch. However, sand-blast machines operate efficiently at a much lower pressure. By interposing a regulator of the type just referred to between the sand blast and the main air line it will be possible, so the manufacturer claims, to effect worthwhile economies.

PORTABLE COMPRESSORS AND AIR-DRIVEN PAVING BREAKERS DOING THEIR BIT IN RECONSTRUCTING THE STREETS OF LONDON

London's thoroughfares are threaded during the waking hours of every weekday by a dense tide of vehicular traffic. Therefore, it is vitally necessary that repairs and reconstruction work shall be done with all practicable dispatch. This speed of performance is now made possible by portable compressors and air-driven tools developed for the purpose.



Exhibition of the Easton Car & Construction Company at the second All-Western Road Show. The air hoist in the middle foreground was used to operate quarry cars to demonstrate their dumping mechanisms.

AIR HOIST DUMPS QUARRY CARS AT EXHIBITION

"HOW does it work?" That is generally the first question a man will ask who is interested in a certain piece of machinery. To satisfy this curiosity, and to simplify the problem of the man to whom the query is put, it is the tendency nowadays at exhibitions to show machinery in operation.

This was exemplified at the second All-Western Road Show, held not long ago in San Francisco, Calif., where much of the equipment on exhibition could be worked for the benefit of the visitors. All sorts of means were employed to bring this about. For example, to demonstrate how their "Won-Way" and "Phoenix" quarry cars are dumped, the Easton Car & Construction Company made use of an air hoist.

As shown by the accompanying illustration, the hoist was mounted on a derrick—the loose end of the cable, passing over a shieve at the top of the derrick, being fastened to a hook at the bottom of the quarry car. Instead of wasting much valuable time in explaining, it was only necessary for the man in charge to operate the air hoist in order to show just how the dumping mechanism of the cars works.

AIR HAMMER DRIVES METAL MARKERS IN ROADWAYS

EVERY motorist has learned to appreciate the value of the white dividing line, especially on curves, that helps him to keep on his side of the road and thus to avoid accidents. In the past, this line has generally been made with paint, which of course does not last long on much traveled roads. With this in mind, the Union Tank & Pipe Company, of Los Angeles, Calif., has devised a marker that is said to be as permanent as the pavement itself.

The Universal marker, as it is called, is made of a 4½-inch plate of high-grade, heavily galvanized steel having a tensile strength of 73,000 pounds. The corners of this plate are bent over to a depth of 1¼ inches, giving four stout prongs that hold the marker in place when firmly driven. And, as our illustration shows, this work is done by a pneumatic paving breaker drawing its air supply from a portable compressor.

Being made of heavily galvanized steel, the markers are said to remain bright—that is, plainly visible in all kinds of weather. In fact, usage has shown that moving traffic tends to give them a high polish even after the zinc plating has been worn off. Competitive tests have brought out that a permanent traffic control line of this description can be put down for the cost of four painted lines, each of the same length as the one composed of the metal markers.

Courtesy, Highway Engineer & Contractor.

Paving breaker, drawing air from a portable compressor, driving metal markers in a much traveled highway.

CANADA MINE DOUBLES HOISTING CAPACITY

TO increase production at their Lake Shore Mine, the Horne Copper Corporation, of Rouyn, Que., is doubling its main hoisting facilities. The new hoist is in course of construction in the Sherbrooke plant of the Canadian Ingersoll-Rand Company, and is almost a duplicate of the one now operating at that mine. It is of the double-drum type, and will be driven by electric motor through herringbone gears. Each of the drums has a diameter of 8 feet and a face of 4 feet, and will be equipped with an axial type plate clutch. Either drum may be used alone, but ordinarily they will be operated in balance.

When completed and installed, the equipment will give a hoisting speed of 750 feet per minute—which will be sufficient to meet all requirements down to the 600-foot level. Later, to maintain the same rate of production after the 1,200-foot level is reached, the speed will be increased to 1,500 feet per minute. To bring about this increase in speed it will be necessary to substitute a 450-H.P. motor for the 250-H.P. motor that will be used when the hoist is first put in service. To assure smoothness of starting, these motors are to be provided with a liquid regulator. The design also calls for safety devices that are capable of preventing accident even in the event the hoistman should faint or be otherwise incapacitated. All hoisting will be done in cars, as too many different kinds of ore are handled at the Lake Shore Mine to use skips conveniently.

PROMISING GOLD FIELD FOUND IN INDIA

IT is reported from India that an extensive gold deposit has been discovered in Patiala. The auriferous area is about 12 to 16 square miles in extent; and assays of the samples collected by the State Mining Engineer have shown between 1½ to 2 ounces of gold to the ton. This is said to compare favorably with the gold in the Mysore fields. Present indications are that the Patiala deposit will prove especially valuable because the gold is in close association with copper, assaying at about 6 per cent., and sulphur. A special grant has been made by the Durbar to cover the cost of boring operations to determine the depth and the approximate extent of the various lodes.

PETROLEUM FROM WATER GAS

THE manufacture of petroleum from water gas has been achieved by a Frenchman, according to *Power*. The process consists in compressing water gas—which is a mixture of hydrogen and carbon monoxide—to 2,850 pounds, and then in forcing it at high velocity over a catalyzer. Probably some reducing agent is also used to absorb the oxygen, which does not enter into the composition of petroleum.

The inventor, M. Audibert, has previously succeeded in making methyl alcohol from water gas; and it is said that a factory is being built for the production of methyl alcohol—to be used as a motor fuel—by his process.

Story of the Portland Gold Mine

New Era of Production Promised in Cripple Creek Through the Success Achieved in the Working of this Property

PART II

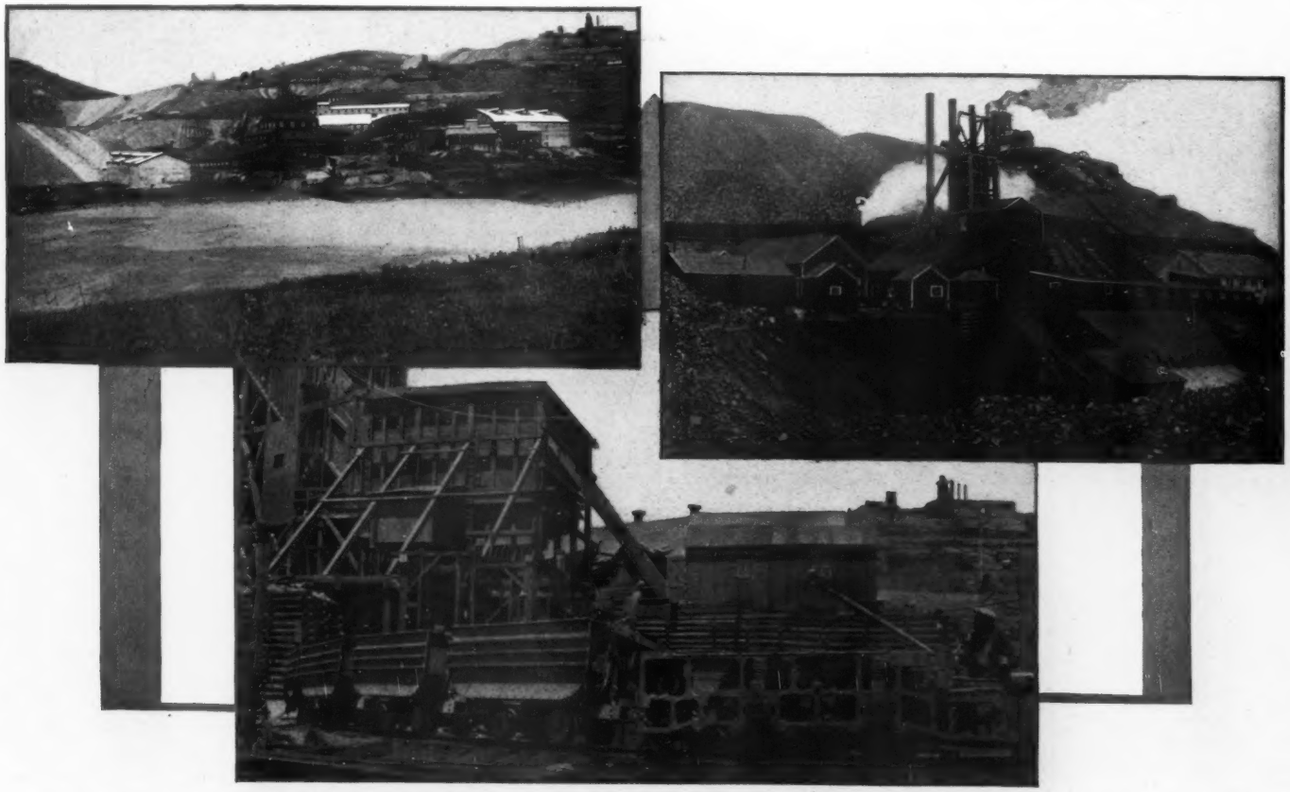
By C. H. VIVIAN

THE first decade of the new century placed the Portland in the vanguard of all the Cripple Creek mines. It was the practice to lease portions of properties which ran out of rich ore to tributers and to gradually decrease company work. This was partly the outgrowth of a short-sighted policy of mining. Instead of conserving the upper workings, the richest ore was stripped from them and they were then abandoned to lessees who "cleaned them up."

The Portland began early to exercise care in mining. Instead of allowing the upper workings to cave, dump rock was sent back down the shaft to fill and to support the stopes. As a result of this system, coupled with the practice previously mentioned of keeping exploratory work ahead of ore depletion, the Portland was in good condition in 1915, while certain of the bigger mines were given over to lessees that were deriving their principal returns from royalties and from working over dumps which had become profitable through advances made in the art of milling.

In 1915, after 23 years of continuous operation and with over 55 miles of underground workings, all the Portland's 18 levels were contributing to the output—lessees having been allowed on only one, the 200-foot level. It was in 1915 that the Portland purchased the Independence. The English syndicate which bought it from Stratton never realized its investment. Lessees held sway in its workings for several years prior to its sale, during which time the huge dump was being fed to the mills to salvage the values that had been discarded during the first years of fabulously rich ore production. From the date of its discovery until it was acquired by the Portland Gold Mining Company, the Independence produced ore worth $23,621,728, out of which sum were paid dividends totaling $8,116,778. The price paid by the Portland Gold Mining Company for the Independence was $323,000—only a small part of the original cost of the mine, the mill buildings, and the machinery.

In 1918 the Portland began to meet its real test. The war caused a shortage of labor and raised the prices of powder, drill steel, and everything else needed to carry on mining. Then, nearly all the big properties in the district suspended operations, or gave possession of their workings to lessees. Fortunately, the Portland management had been building up a surplus while maintaining dividends, which amounted to as much as 36 cents a share, having a par value of $1, in the banner year of 1905. In 1918 this surplus reached its peak of $1,785,000; and it was in that year the mine showed its first operating loss—the deficit being $171,132. The 1919 loss was $92,817. Dividends were paid out of that surplus during those lean years and up to December, 1920, when the board of directors voted to discontinue them and to conserve their financial resources for the ensuing struggle to put the property back on a paying basis. In 1921 the loss amounted to $197,729, following the $442,094 loss of 1920, previously mentioned. In 1922 the property fell in arrears to the extent of $256,838, and in



Top, left—Portland mill where the low-grade ore is treated. Right—Portland No. 1 Shaft, which has reached a depth of 1,700 feet. Just back lies No. 2 Shaft, which is 3,031 feet deep. Bottom—Type of train used to carry the ore from the mines.

1923 a deficit of $181,135 was experienced. The company was by this time in debt to the sum of $453,000.

But for repeated misfortunes, the year 1923 might have shown a profit. It was during that year that the Roosevelt Tunnel, a drainage artery, caved badly, necessitating extensive repair work. As the Portland and the Cresson were then the only mines on an operating basis, they jointly had to shoulder the financial burden entailed. The work was both costly and fraught with difficulties. It involved operating the Elkton Shaft and required the laying under water of 2,500 feet of railroad track. To give permanency to the structure, the caved sections

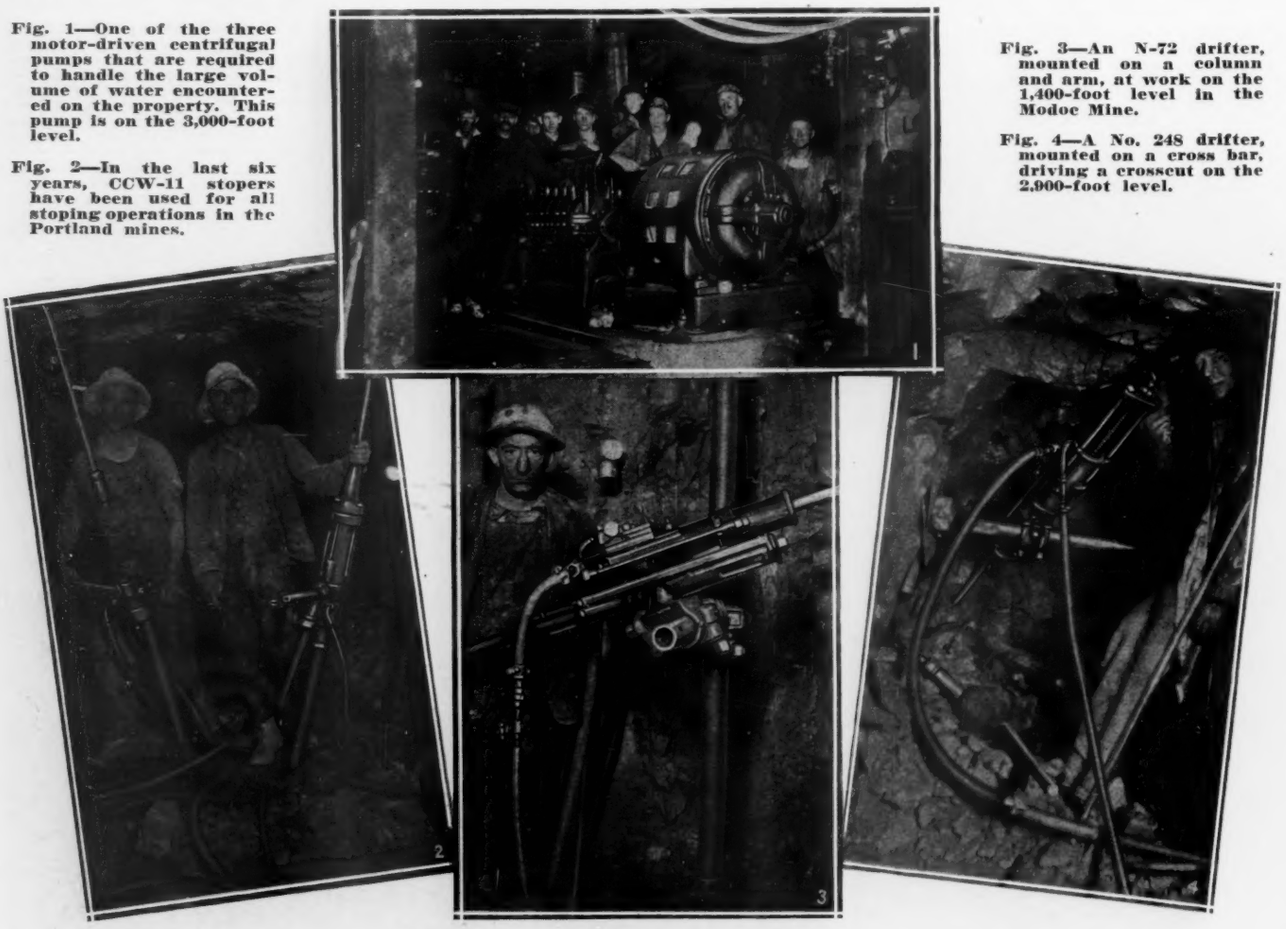


Fig. 1—One of the three motor-driven centrifugal pumps that are required to handle the large volume of water encountered on the property. This pump is on the 3,000-foot level.

Fig. 2—In the last six years, CCW-11 stopers have been used for all stoping operations in the Portland mines.

Fig. 3—An N-72 drifter, mounted on a column and arm, at work on the 1,400-foot level in the Modoc Mine.

Fig. 4—A No. 248 drifter, mounted on a cross bar, driving a crosscut on the 2,900-foot level.

were reinforced with 10-inch concrete arches. Right on top of this mishap, a cave-in on the 2,600-foot level of the Portland cut off production from the principal ore body for an interval of three months.

The mineralized area of the Cripple Creek district is roughly elliptical in surface outline, being approximately 5 miles long by 3 miles wide and having a northwest-southeast axis. It represents the crater of an extinct volcano, of Tertiary times, in which the resultant materials were mixed up as in a seething caldron. The Portland properties are at the southeast extremity of this volcanic formation.

The characteristic ore structure of the Cripple Creek district is the sheeted zone. This consists of a varying number of narrow, approximately parallel fissures which form a lode ranging in width from a few inches up to 50, 60, and sometimes 100 feet. Within the wider belt of fracture can usually be found two or more zones of concentrated fissures the seams of which lie close enough together to be mined as a whole. The prevailing gold-bearing mineral is calaverite, in which the silver content is usually negligible.

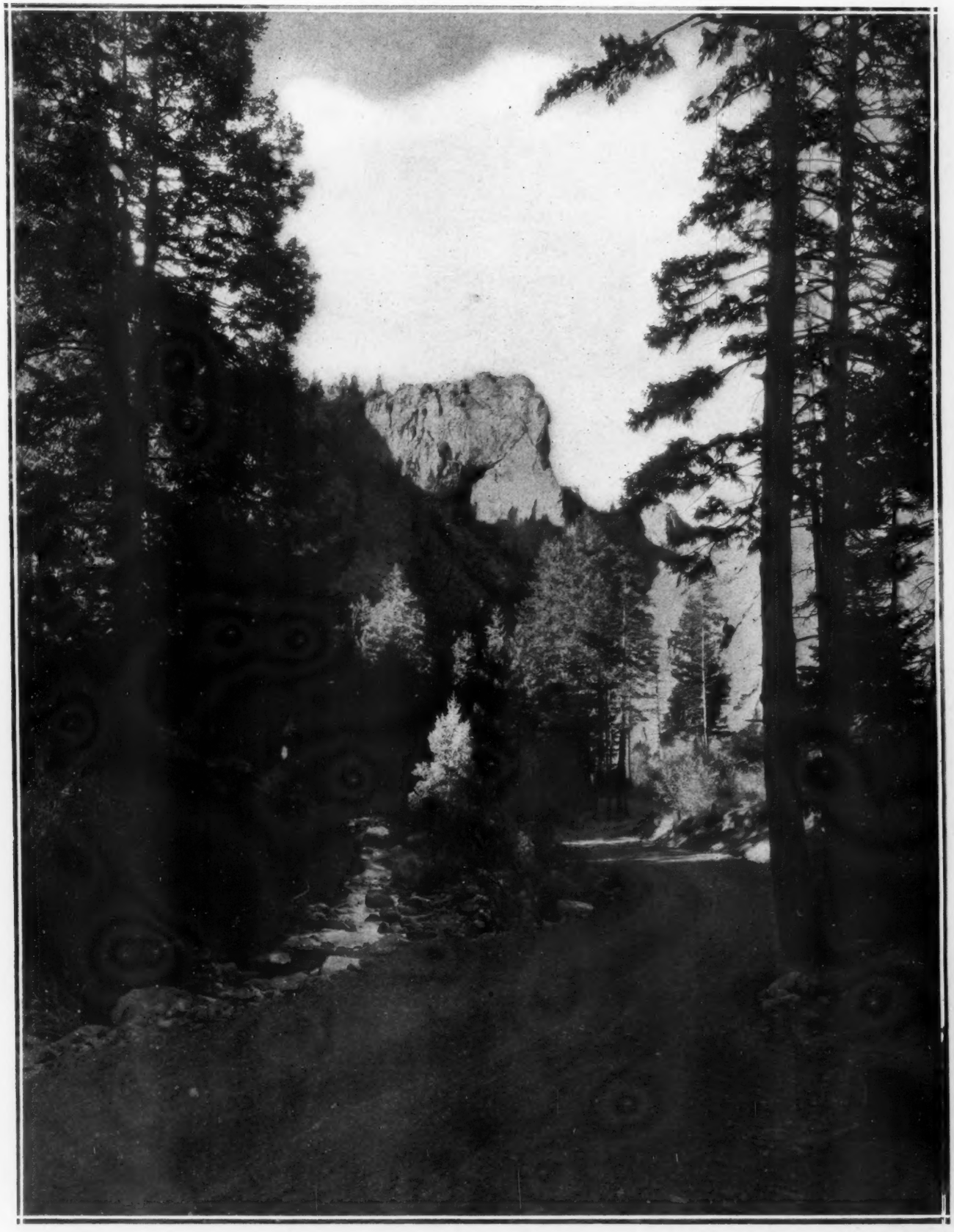
As stated before, well-defined fissure veins, mineralized to the point where they can be classed as lodes, are rare. Of those known at present, the longest run for a distance of but half a mile—many of the most productive vein systems being remarkably short. Furthermore, many of the lodes do not reach to the surface, while those that do have been hidden in the course of time by an overlying mantle of earth. These facts explain not only the delay in the discovery of Cripple Creek but also the perplexities that met the mine operators on every hand.

During the earlier years of its operation, the Portland struck an unusually large number of short vein systems. Chief among them was the Captain system, a series of parallel zones of which the longest ore body was 300 feet in extent. This ore body attained no importance until it was cut on the 220-foot level. Although the fissures persist with depth, the ore is of low grade below the 600-foot level; and at 1,000 feet it was not worth mining. This system of veins has not been cut below the 1,700-foot level, where all the members were barren. It is the present intention of the company to prospect them at some of the lower horizons.

In the southern part of the Portland property the early workings cut what is called the Diamond system of veins, another short series of highly mineralized fissures whose ore bodies did not persist with depth. At one time, a single stope on the 600-foot level yielded sufficient values to pay all the operating expenses of the mine for a period of months—the values averaging more than $100 to the ton as shot down in the stope, while a number of carloads ran $600 to the ton.

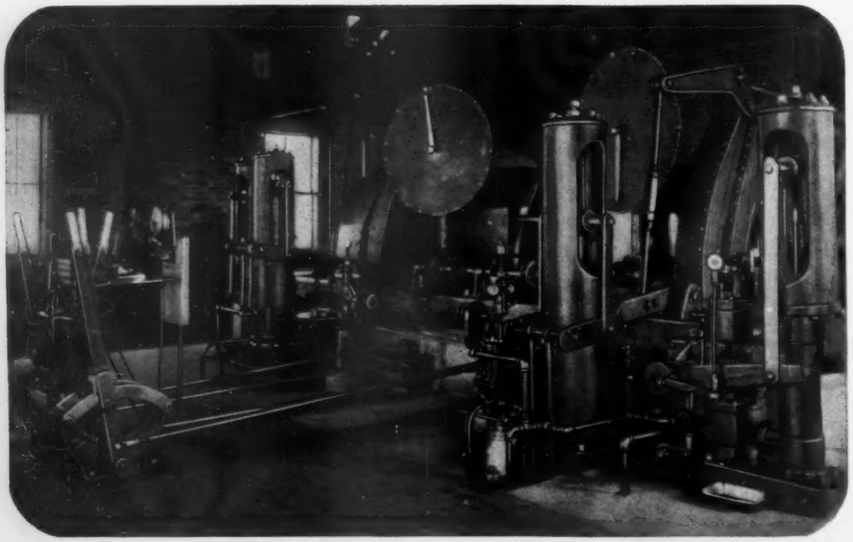
Any detailed description of the ore bodies and their occurrences is impossible, as experts admit that the Portland workings have revealed a larger number and a greater variety of lodes than any other mine in the district. The foregoing, however, emphasizes the need of carrying on extensive prospecting if a mine is to be kept on a profitable basis, and likewise gives a hint of the great amount of exploratory work that the Portland has at all times had to do to insure a future ore supply. That success has in the end always characterized these efforts is a record of which the managerial and the engineering departments of the Portland Gold Mining Company can justly be proud.

The Portland holdings today consist of an irregular strip of ground, a mile long and one-third of a mile wide, extending in a general north and south direction across the eastern end



Courtesy, Pikes Peak News Bureau

A beautiful stretch of road traversing the North Cheyenne Canyon in the Colorado Springs park system.



This electric hoist in the Last Dollar Mine is the largest equipment of its kind in the district.

of Battle Mountain. At the south end is Stratton's Independence, with a shaft 1,430 feet deep. In the middle ground is the original Portland property with its No. 1 Shaft, 1,700 feet deep. North of this is the No. 2 Shaft, bottomed at 3,031 feet. At the extreme north end is the Last Dollar property, with a 1,500-foot shaft, purchased in 1925 to settle a long-existing apex controversy. All other shafts used in the early days are now abandoned. Principal among these is the No. 3 Portland, which was sunk to a depth of 1,155 feet. As Battle Mountain rises rather sharply from south to north, the difference in surface elevation between the Independence and the Last Dollar—at opposite ends of the property—is 400-odd feet. The collar of the No. 1 Shaft is 10,089 feet above sea level, while that of the No. 2 Shaft is 162 feet higher.

Company operations are now confined to the No. 2 and the Independence shafts—explorations into deeper horizons being carried on through the No. 2 Shaft. The workings tributary to the Last Dollar and No. 1 shafts are at present partly leased. The mine offices, blacksmith shops, carpenter shops, etc., are situated adjacent to the No. 1 Shaft. All the mine equipment used is modern—the Portland having the reputation of thus maintaining operating efficiency and of providing every precautionary measure necessary to insure the safety and the welfare of its workers.

The No. 2 or main shaft is of the 3-compartment type: two compartments are given over to skipways, while the third is provided for the needful air, electric, and water lines. In the sinking of this shaft DCR-23 "Jackhamers" were used exclusively. The cost of shaft sinking in recent years is given as approximately $70 a foot, which includes the expense of pumping water—a considerable item.

Steam is employed for hoisting in both the No. 2 and the No. 1 shafts. The hoist at the Last Dollar, the largest unit of this type in the district, is electric. The Indepenence Shaft is also equipped with an electric hoist, the change from steam having been made in 1924 to increase the capacity of the hoist for handling mill dirt. Balanced skips are used. These skips, with the exception of those at the No. 2 Portland which are of 4-ton capacity, weigh 3,600 pounds each and hold 3 tons of ore. The unbalanced load is 13,600 pounds and the balanced load is 10,000 pounds. Allowing 60 seconds for loading and 135 seconds for hoisting at a normal maximum cable speed of 1,000 feet per second, the installation described will make 18.4 trips per hour—giving a hoisting capacity of 55.4 tons per hour from a depth of 2,000 feet. Each brake drum, which has a diameter of 80 inches, is provided with a safety device, of the Royer & Sweibel type, which automatically cuts off the power and applies the brake in case of overspeed and when the operator fails to slow down when approaching the shaft collar. The device also acts in case of failure of line current.

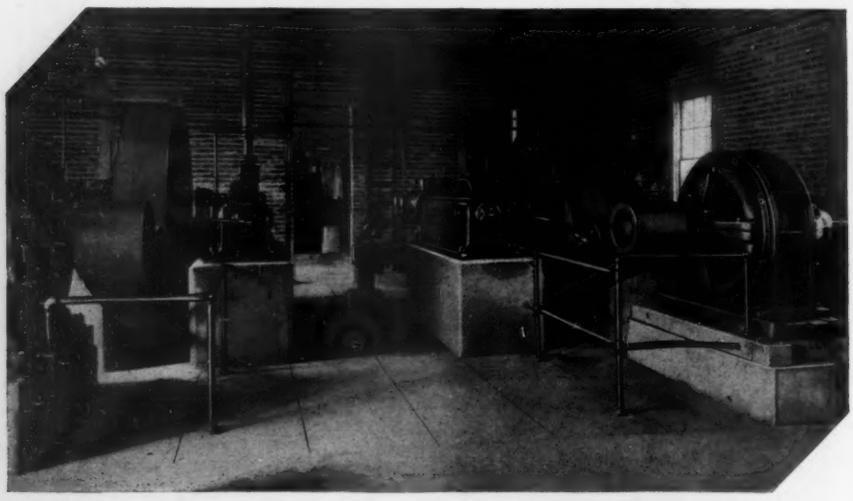
Overhead stoping is the method employed in mining. Square-timber sets are used in the larger openings, although the rock is commonly so hard that it requires little if any support in stopes of considerable size. The general practice is to draw the material, as desired, from the stopes through chutes. Three-quarter ton mine cars transport the ore to the shafts.

The air supply for the No. 2 Shaft is furnished by three Ingersoll-Rand compressors: two 19&10½x14-inch Type "XRB-2" machines and one 21&12x16-inch Type "XB-2" unit. These compressors are belt driven from motors and, respectively, deliver 1,098 and 1,085 cubic feet of air per minute at 100 pounds pressure. As an auxiliary, there is a 42-inch Ingersoll-Sergeant steam-driven compressor. The Last Dollar and the Independence shafts are each supplied by an 18&10x14-inch Type "XB-2" machine with a capacity of 759 cubic feet of air per minute. These compressors are also belt driven from motors. The air main in the No. 2 Shaft is 8 inches in diameter down to the lower levels, where it is reduced to 5 inches. The No. 1 and the Independence shafts carry 4-inch air mains, and the Last Dollar Shaft one 2½ inches in size.

For rock drilling, the Portland Gold Mining Company has used No. 248 drifters exclusively for the last six years. In driving an 8x8-foot drift between the Portland and the Independence shafts, two of these machines, mounted on an 8-foot crossbar of 3-inch diameter, averaged an advance of 8 feet 5 inches a shift. In this work, 24 holes were drilled to a round. In the same interval—that is, during the last six years, "CCW-11" stopers have been employed in all stoping operations. As some of the rock is particularly hard and resistant, the drilling machinery has been put to a severe test. In drifting operations, difficulty has sometimes been experienced in breaking ground properly with 24 holes to an 8x8-foot face.

In the well-equipped blacksmith shop are two "Leyner" drill sharpeners, a No. 50 and a No. 4. These units sharpen on an average 800 drill steels a shift. The machine and the carpenter shops are completely outfitted, the latter framing all the timbers used on the property. Blasting is done by electric battery; and the explosives magazine is in an isolated portion of the mine 1,700 feet underground.

At intervals of approximately 300 feet in the



Compressor plant in the Last Dollar Mine.

Courtesy, Pikes Peak News Bureau.

Bird's-eye view of Manitou, Colo. The road leading off to the left extends for a distance of 45 miles to the Cripple Creek mining district.

On the 2,900-foot level in the Portland Mine, with Superintendent Fred Jones in the foreground.

No. 2 Shaft are loading pockets. These pockets are equipped with air-lift gates that control direct loading of the ore into the skips. Upon reaching the ore house, the skips dump automatically—the ore passing over ¾-inch grizzlies. It is characteristic of Cripple Creek ores that the higher values are found in the fine material because the seamy character of the veins causes the ore, when shot down, to become finely divided. Formerly ore sorters were used to separate the ore from the waste and to cob the fine material from the surface of large pieces of rock. In recent years, however, these have been dispensed with. Now, the material passing through the grizzlies is classed as ore and shipped to the Golden Cycle mill, at Colorado Springs, while the oversize comes under the heading of mill dirt and is milled at the company's own plant on the Independence property.

Water has always presented a serious problem at the Portland, as it has in all mines of the district. Water was first encountered in the Portland at a depth of 630 feet. Pumping had to be resorted to, and it has never stopped from that time on. In the beginning, the flow was but 300 gallons a minute, but in 1896, when a depth of 704 feet was reached, the flow increased to 700 gallons a minute. In 1899 it amounted to 1,180 gallons a minute, and has varied little since that time.

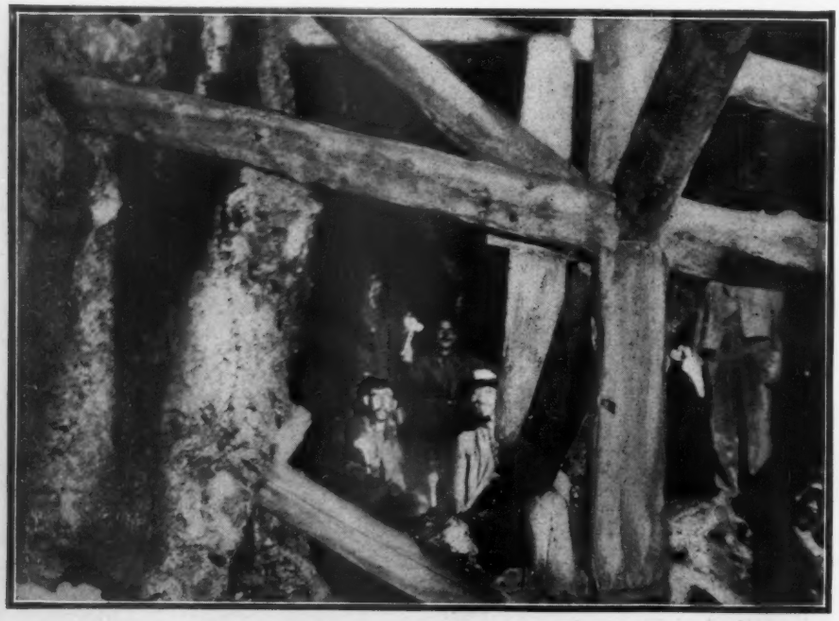
Several drainage tunnels were driven to alleviate the water conditions in the camp. The last and the lowest of these is the Roosevelt, whose portal is in a gulch southwest of the area. It was started in 1905, and reached the contact between the granite and the volcanic neck a few years later. Upon completion, it did not lower the water in the mines as much as was expected, but as it has increased in length to suit requirements the tunnel has become more effective. The Roosevelt drainage tunnel is now 24,255 feet long; and the Portland Gold Mining Company paid $144,951 towards its construction cost.

Direct connection with the tunnel was not made by the Portland until January 1, 1919, at which time a crosscut was driven to intersect it. In the Portland, the tunnel is at the 2,131-foot level; and at present the water must be lifted 900 feet to reach it. The water sump is located beside the shaft sump and has a capacity of 55,000 gallons. The water is handled, through a 10-inch column, by 5-stage, bronze, centrifugal pumps. There are three of these motor-driven units: one has a capacity of 1,000 gallons a minute against a 1,000-foot head and the others are each capable of handling 400 gallons a minute.

The necessary motive power comes from Canon City, which is situated on the plains 40 miles to the south. As a safety measure, and to prevent the water from drowning the pumps in case the current should fail, steel-and-concrete doors are provided on the 2,900- and the 3,000-foot levels. As a further precaution against stoppage of the pumps the company, in 1921, installed a small standby generating set to furnish power in emergencies. Some of the water now encountered on the 3,000-foot level has a temperature of 83° F. The other principal flow is of 81°F.

During the early days of mining in the region, some trouble was experienced with gaseous workings; but as substantially all the mines are now interconnected the air has a chance to circulate freely. It is said that, by a little maneuvering, it is possible to go down the Independence Shaft at the southwest border of the district and to emerge almost in Cripple Creek. By road, the two points are six miles apart.

(*To be concluded*)



System of square-set stoping employed in the mine workings.

"In the granulation of slags and metals by quenching," says B. Bogitch, in *British Chemical Abstracts*, "dangerous explosions may occur if too much molten metal is entrained in the molten slag. A jet of compressed air introduced below the water surface serves to retard and break up the molten stream, and to prevent the formation of a solid sheet over the surface of the vessel. Experiments with an iron-magnesium silicate slag and a molten metal, using air compressed to 2.2 pounds, showed that quenching may safely be carried out in smaller vessels, and from a lesser height than is usual."

Oil-Engine Tug "Samson" Put Through Paces For Prominent Shipping Men

By PETER A. SENSENIG

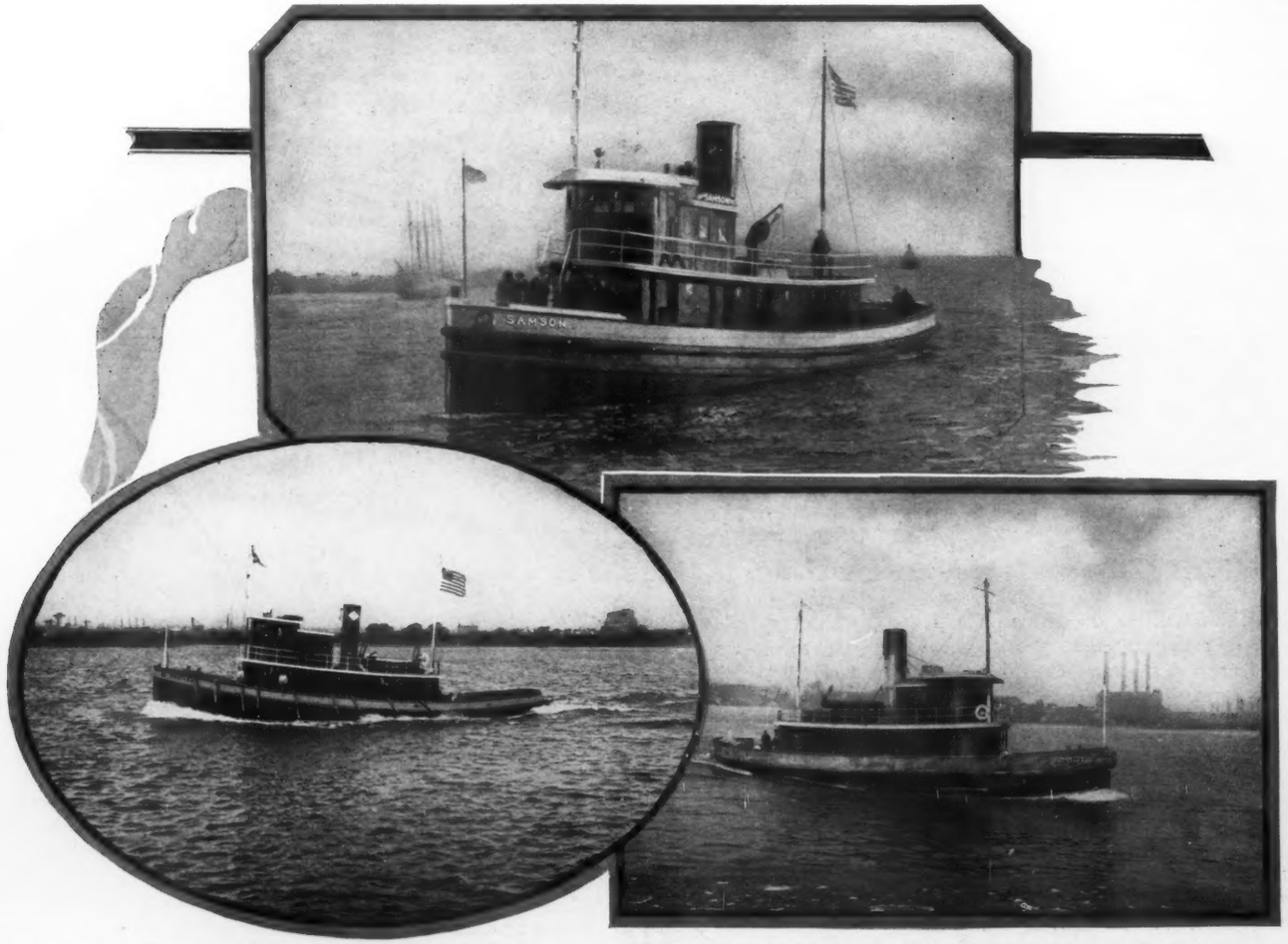
"YES, we thought we were taking a gamble when we built a tug and fitted it with an Ingersoll-Rand oil engine, but we won; and, what is more to the point, I am at present building a larger tug in which we will put a larger Ingersoll-Rand oil engine. This time, I know that the undertaking is not a gamble, and I shall name the boat *Samson.*"

In these words Mr. George F. Pettinos summed up an argument made by him some time ago in favor of oil-engined tug boats. That he was correct in his contention was again demonstrated on Navy Day, when the *Samson* was put through her paces in Chesapeake Bay before a large number of shipping men. On that short cruise the craft maneuvered to the entire satisfaction of her owners; and the men aboard commented favorably on her general efficiency and on the smooth running of her oil engine—being especially impressed with the instantaneous response of the engine to the movements of the single-lever control.

After this trial run, and without any further engine tests, the *Samson* left Baltimore for Philadelphia, where she was assigned to a coastwise towing job. Within a few minutes after taking on necessary supplies and fuel oil, she was on her way with a barge laden with 8,000 barrels of oil destined for Wilmington, N. C. Despite the fact that she encountered bad weather, the tug towed the barge from Delaware Breakwater to the dock at Wilmington, N. C.—a distance of 475 miles—in 57 hours. Arriving at Wilmington, the barge was unloaded and towed to Brunswick, Ga., where she took on another cargo of 8,000 barrels of oil consigned to Wilmington. Before returning to her home port, the *Samson* made three such round trips between those two Southern ports —towing the barge in light condition to Brunswick and laden to Wilmington. Including the run from Philadelphia, she covered approximately 3,000 miles in delivering 32,000 barrels of oil. During the entire trip, the *Samson's* 400-B.H.P. Diesel engine consumed 8,000 gallons of fuel. With oil at six cents a gallon, this made an average cost per tow-mile of sixteen cents.

The *Samson* is owned by George F. Pettinos, and is the third and largest Diesel-engine tug to be built for that well-known shipping man of Philadelphia. The other tugs are the *Hustler* and the *Sonittep,* both of which have been described in this Magazine. The *Hustler* has the distinction of being the first direct-connected and reversible Diesel-engine tug, controlled by a single lever, to be put in commission in American waters.

When the construction of the *Hustler* was under advisement, towboat owners were a little skeptical as to the practicability of the oil engine for their work. There being no precedent to guide them, it took some courage on the part of the Diamond P. Transportation Company to make a departure. But this they did, after a thorough study of the subject, and the *Hustler*



The tugs "Samson," "Hustler" and "Sonittep" that are being used successfully in harbor, bay, and long-distance coastwise towing service. The direct-connected, reversible Diesel engine installed in each of these boats is under the control of a single lever.

was equipped with an Ingersoll-Rand 6-cylinder, 4-cycle, moderate-compression, solid-injection, reversible marine oil engine, with a 13-inch bore and a 19-inch stroke, rated at 320 B.H.P. when running at 250 revolutions per minute.

The *Hustler* was put in service in August of 1923. From the very start she exceeded the expectations of her owners. In a comparative test with a steam tug, both doing the same kind of work, she not only proved superior but also demonstrated that her fuel cost was less than half that of the steam tug. After a trial of five months with this Diesel-engine tug it was found that the operating expense, as compared with the steam tug on the same class of work, was 60 per cent. of the cost of the steam tug. One of the outstanding achievements in the history of the *Hustler* was her winning of a tug-of-war with one of the largest and most powerful steam tugs in Philadelphia Harbor. This tug was equipped with a 15x30x22-inch, fore-and-aft, compound engine.

On the strength of these performances, Mr. Pettinos decided to add another Diesel-engine tug to his fleet. At that time the United States Government was offering a twin-screw steam tug for sale. This was purchased and converted along the lines of the *Hustler* into a single-screw boat subsequently named the *Sonittep*. The *Sonittep* has been in ocean-going towing service since May of 1924, and within that time has never been laid up for repairs. The tow usually consists of two 900-ton sand barges which are loaded at points on the Delaware River and towed to Boston. The run to Boston averages about 72 hours; but when returning in light condition to the home port, at Millville, the time is reduced to 56 hours. Three such round trips can be made without refueling; and each is made without stopping en route for supplies or water. The fuel consumption for the 320-B.H.P. oil engine in this class of service averages 18 gallons an hour costing less than $1.

The *Sonittep* was also used last year for towing two lumber barges from Jacksonville to West Palm Beach, Fla., a non-stop run of 300 miles. She has thus earned for herself the distinction of being the first direct-connected Diesel-engine tug to be employed regularly for long-distance coastwise towing in American waters. And this brings us again to the *Samson*, the newest and the largest of the Diesel-engine tugs operated by Mr. Pettinos.

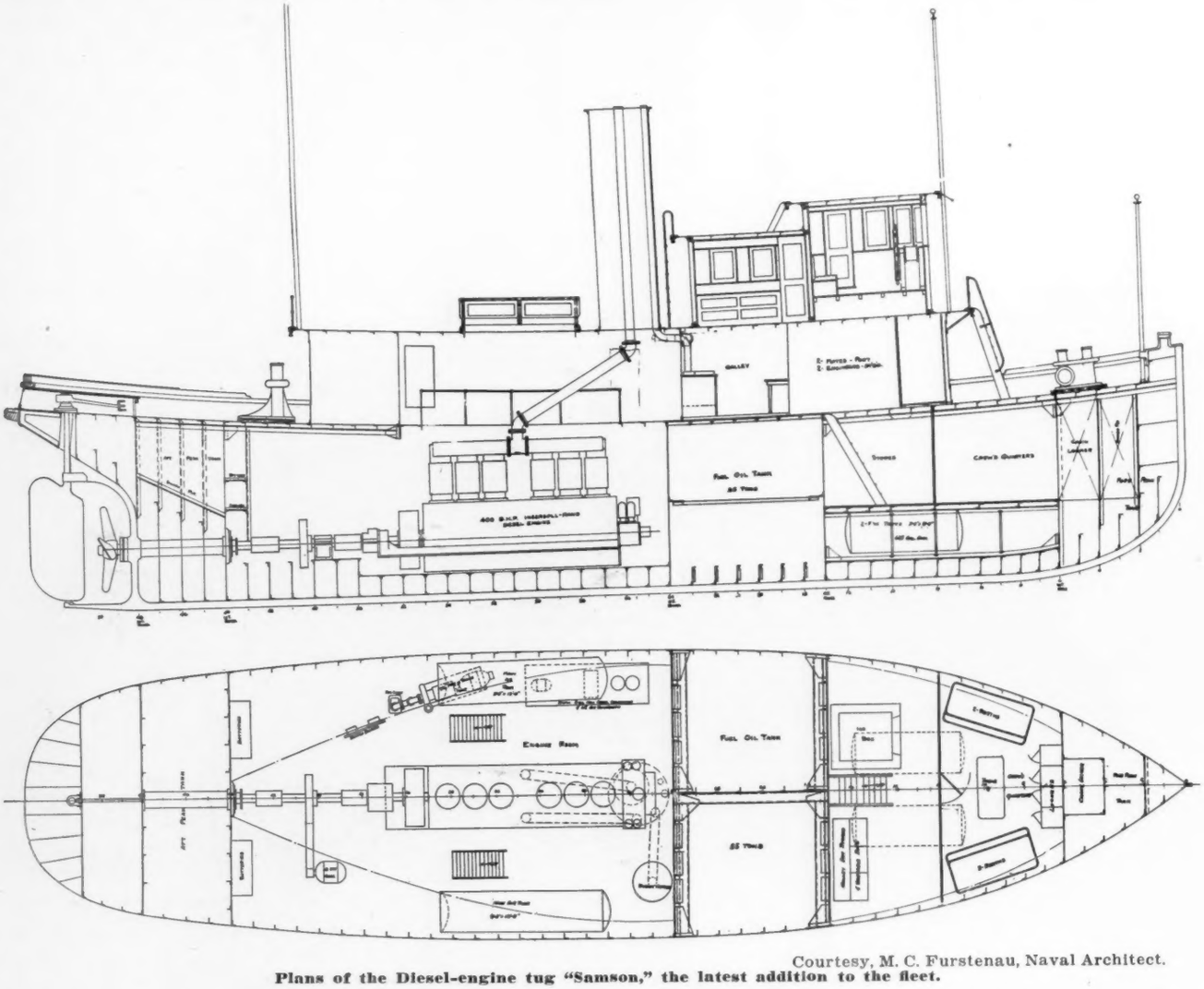
The *Samson* is of all steel construction, and her principal dimensions are:

Length on deck.....	87	ft.
Length, perpendiculars...	79	"
Breadth, molded.....	21	"
Depth, molded.....	11½	"
Draft, mean.....	9	"

The craft is equipped with an Ingersoll-Rand, 6-cylinder Diesel engine rated at 400 B.H.P. when making 265 revolutions a minute. It is of the single-acting, trunk-piston, direct-injection type, and operates on the 4-stroke cycle. In this Type "PR" marine oil engine are combined the simplicity of the so-called semi-Diesel type and the fuel economy and cold-starting features of the air-injection Diesel engine. As it operates on the direct-injection system, there is no need of a 1,000-pound, 3- or 4-stage air compressor, with its numerous accessories, such as intercoolers, aftercoolers, high-pressure air piping, and injection air bottles. By eliminating these, the following advantages are gained:

A reduction in weight of 10 to 12 per cent.

Decrease in overall length of engine.



Courtesy, M. C. Furstenau, Naval Architect.

Plans of the Diesel-engine tug "Samson," the latest addition to the fleet.

Gain of from 10 to 15 per cent. in mechanical efficiency and a resultant decrease in fuel consumption per horse power delivered.

Simplicity of construction and a consequent increase in reliability and durability.

Fewer delicate parts, and a corresponding reduction in maintenance costs.

All the valuable features of the air-injection engine are embodied in the design. The compression employed is appreciably less than that necessary in the case of the air-injection Diesel—the reduction being made possible by reason of the elimination of the refrigerating effect of the expanding injection air. There is more than enough compression to start the engine from a cold condition without the use of hot bulbs, hot plates, hot tubes, electric igniters, or other sources of extraneous heat.

The long list of fuels ordinarily recommended is augmented somewhat because the manufacturer of the "PR" type of engine sanctions the use of fuels containing a higher percentage of sulphur. Because of the higher mechanical efficiency of the engine it consumes less fuel per brake horse power.

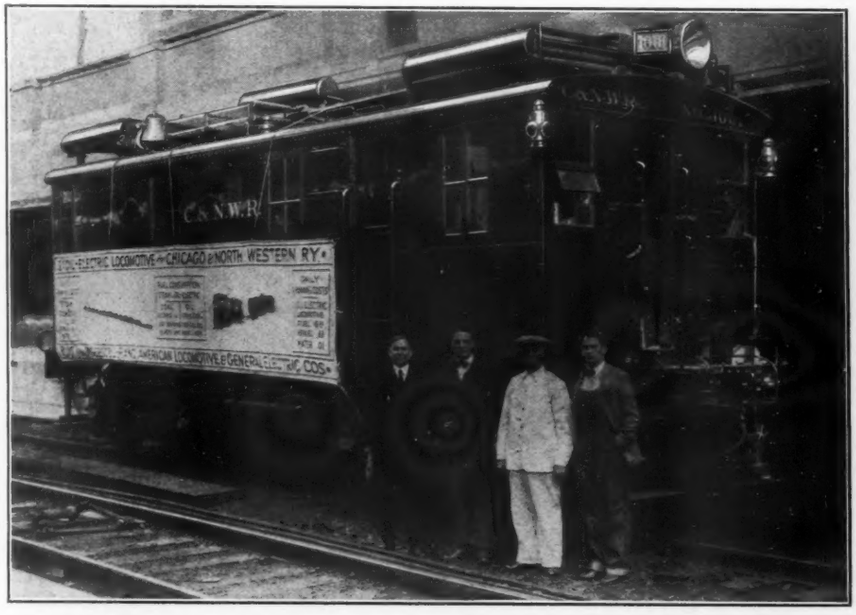
Two water pumps, that can be used either for circulating water or ballast, are direct connected to and form an integral part of the engine. The engine is also provided with two lubricating oil pumps; and the main air compressor is built in at the forward end and is a part of the engine proper. The auxiliary machinery consists of one 3-cylinder, full-Diesel engine direct connected at one end to a 12-kilowatt generator and at the other to a 2-stage compressor, and of a 2½-inch centrifugal fire-and-bilge pump having a capacity of 250 gallons of water per minute at 50 pounds pressure. This pump is driven by an electric motor; and a connection is provided for pumping out barges. The main fuel-oil pump, with a capacity of 35 gallons a minute, is driven by a 1-H.P. motor. In case of emergency, a hand-rotary pump can be used to transfer the fuel oil. When the tug is underway, an 8-kilowatt generator, belt driven from the main shaft, supplies electric power, while a storage battery of 100 cells, 110-volt output, furnishes sufficient energy to light the ship when the generators are not running. A low-pressure boiler is fitted to furnish steam for the heating system; and in this connection it is interesting to note that both the boiler and the galley range are equipped to burn the same fuel oil as is used in the main engine.

Not long ago, electric lamps in the Back Bay district of Boston were lighted for a time by power from Chicago. To accomplish this, more than a dozen light and power companies were linked in a 1,000-mile "hook-up." The test—the first to be made over so great a distance—was not undertaken to prove the commercial feasibility of such a "hook-up" but to demonstrate the practicability of power interchange between companies and the distance over which current might be sent. According to Robert E. Billon, head of the regenerating department of the Boston Edison Company, the experiment is but "a step in the development of a single huge power line running from coast to coast."

Oil-Electric Locomotive Arouses Interest

THAT the public has come to look upon the oil-electric locomotive as an established factor in American railroading was apparent to observers who accompanied the new locomotive *No. 1001*, of the Chicago & North Western Railway, on its recent run from Schenectady to Chicago, where it has been put into yard and switching service in the congested pier district on the north bank of the Chicago River.

Although it was the first time an oil-electric locomotive had traversed the route via Buffalo, lower Canada, and Detroit to Chicago, the throngs that gathered to inspect the engine at the various stops along the run seemed quite familiar with its outstanding features, namely, economy of operation, and absence of smoke and noise. Questions put to the personnel aboard the locomotive, which made the trip under its own power, indicated a desire to learn the extent to which American railroads were being equipped with this new type of electric tractor.



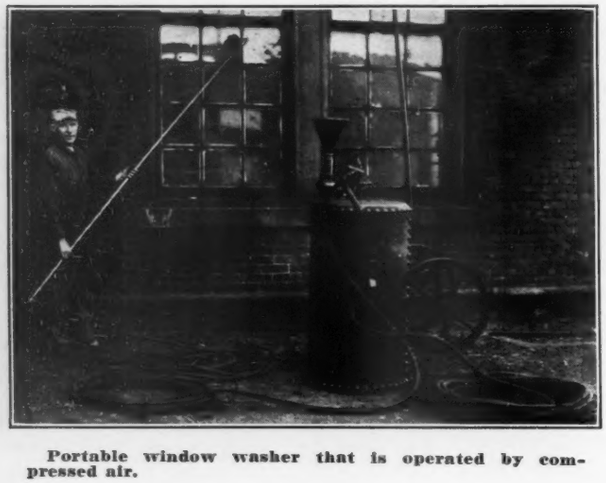
This 60-ton oil-electric locomotive is now doing the switching and the yard work that formerly required the services of two steam locomotives. It is the second locomotive of its type to be placed in the Chicago pier district of the Chicago & North Western Railway.

The fact that this 60-ton locomotive—which is the joint product of the Ingersoll-Rand, American Locomotive, and General Electric companies—is the second to be bought by the Chicago & North Western Railroad for use in the Chicago pier district, was widely commented upon by the viewing crowds. It is noteworthy that each oil-electric locomotive displaces two steam locomotives, apart from eliminating the smoke nuisance that formerly prevailed in that business section.

The oil-electric covered the distance between Schenectady and Chicago in four days, making numerous intermediate stops to permit at least 50,000 people, that had gathered at the different station platforms, to get a close-up view of this newcomer on the rails. Among those who inspected the locomotive were railroad and city officials, members of Chambers of Commerce, and of Rotary and Kiwanis clubs, and college and university students.

On the 820-mile run, the oil-electric—substantiating its previous claims to economy—consumed on an average 52 gallons of oil daily, traveling over 3.34 miles on each gallon of fuel. The average cost per day for fuel was $2.80 and for lubricating oil twenty-five cents, making a total of $3.05, or an average cost of fuel oil per mile of one and one-half cents. Officials of the Chicago & North Western Railway have made public certain figures which show that the sister locomotive, put to switching and yard work some time ago, has cost on an average $44 a day, as against an average expenditure of $82 for the steam locomotive previously engaged in the same service.

A new asphalt mixer has just been placed on the market by Hetherington & Berner that is so constructed that either steam or compressed air may be used to operate the gate cylinder. The machine has a capacity of 2,800 pounds of surface mixture or of 2,500 pounds of coarse stone mixture.



Portable window washer that is operated by compressed air.

AIR-OPERATED WINDOW CLEANER

THERE is a growing tendency to construct the walls of industrial establishments largely of glass both for the sake of economy and so that the work may go on under the most ideal conditions as regards light and air. Then, too, where there is plenty of daylight, cleanliness generally prevails. But, to get the full benefit of the light, the windows must be kept clean, and that is no small item—not to mention job—where hundreds of panes of glass are involved.

It will therefore interest the managements of such plants to learn that there has been developed a mechanical window cleaner that makes it possible to do the work well and quickly. The apparatus is not on the market, but was devised by an ingenious gang foreman, C. E. Mortlock, employed in the Wilmington enginehouse of the Pennsylvania Railroad System.

The window-washing apparatus is operated by compressed air, and consists principally of a water tank, a revolving brush attached to a long piece of pipe, and suitable lengths of water and air lines. When in operation, the water flowing into the tank is forced by air, at a suitable pressure, up through the ½-inch pipe to the brush which, because of its revolving action, cleans the windows rapidly—only one man being required to handle the outfit and to do the work. It is said that at the enginehouse in question it was possible for one man, using the air-operated window cleaner, to wash as many 12x12-inch panes in one day as two men could wash by hand in one week.

AERATED CEMENT

ONE of the buildings at the Sesquicentennial Exposition, in Philadelphia, is constructed of a new kind of concrete that is finding increasing favor in Europe among builders and contractors. The material, which originated in the A. B. Vallevikens Cement-Fabrik, located in Sweden, contains a gas that makes the concrete lighter per unit of volume than is the case with ordinary concrete.

By introducing a gas in the mix, chemical reactions take place that are not unlike those produced by yeast in breadmaking. In short, the result is a cellular formation which, aside from the characteristics mentioned, is said to be both waterproof and soundproof. The material can be cast in big blocks or slabs at the point of use and cut up, after it has set, by means of steel wires.

USE OF COMPRESSED AIR IN BRIDGE BUILDING

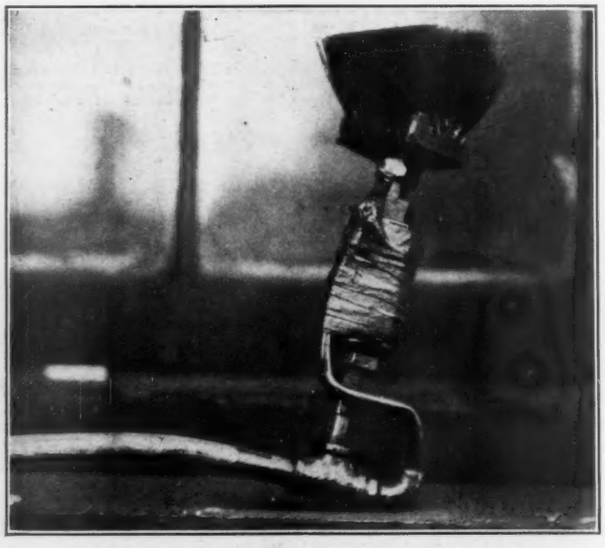
THAT bridge builders consider air-driven tools an important factor in the prosecution of their work, was brought out in a report published by a committee of the Bridge & Building Association after a meeting held not long ago at Richmond, Va. That part of the report dealing with compressed air reads as follows:

Steel bridge erection always suggests the use of riveting hammers, but these tools are now so familiar to most of us that they require no special consideration here. Drilling and reaming are frequently called for. A pneumatic drill will make a ⅞-inch hole in a ½-inch plate in 30 seconds, as compared with 20 minutes when done by hand. Air chipping hammers are the quickest and the cheapest means of cutting out old rivets. In the building of steel tanks, a calking tool is an economical means of making tight joints. In the case of timber bridges, the air-drilling machine facilitates the work of framing. A ⅞-inch hole can be bored through 24 inches of wood in 40 seconds—a small fraction of the time consumed by the hand-operated ship auger. Attachments for this tool serve to tighten lag screws and screw-spikes.

Compressed air drives several machines that are handy and economical in foundation work. "Jackhamers" and tripod drills are faster and cost less to operate than hand drills in making holes in ledge rock or boulders for blasting. In tearing out old masonry and concrete structures, air drills more than justify their cost if the job is at all large. The tools generally employed for this purpose are called paving breakers. Compared with hand methods, the saving is over 70 per cent. The sharp steel in the "Jackhamer" is also used to great advantage in picking frozen ground.

There are a number of attachments to the air hammer suitable for various types of construction work. One recent development is a spade that eliminates hand picking in trenching. Another is the backfill tamper, a light but effective tool. A rather sharp-edged tool designed for cutting asphalt is convenient in cutting out mastic waterproofing in bridge replacements. Rotating pneumatic wire brushes are useful in cleaning steel bridges for painting. Carborundum wheels, fitted to the same tool, are helpful in grinding down steel plates for a tight fit and do the work at low cost.

Compressed air has one of its most important uses in the sand blast. The sand blast is utilized for cleaning steelwork preparatory to painting, and is also employed to advantage in cleaning building surfaces. Loads up to 1,000 pounds or more may be lifted by small air hoists which may be equipped either with a winch head or rope drum. Hoists of this kind are handy in spotting cars on a construction siding, and they can likewise be used to draw culvert pipe into place.



Photos, Courtesy Railway Mechanical Engineer.
Close-up of the revolving brush.

MORTAR BEST SUITED TO COLD-WEATHER USE

TESTS recently conducted at the University of Wisconsin to determine the kind of mortar best adapted to cold weather use are of particular interest to builders at this season of the year. In these experiments, attention was given to the shear, tensile, and compressive strengths of mortars cured both in warm and in cold storage. Eight lime and Portland cement mixes and four bricklayers' cements were tried out. Following the tests it was announced that the most practical mortar for winter use is a lime-cement compounded from one part cement, two parts lime, and nine parts sand.

In arriving at this conclusion, consideration was given to the various requirements, including strength, workability, and economy. It is pointed out that the mortar not only works well in cold weather and answers ordinary strength demands but that it is also satisfactory from the standpoint of cost. The necessary materials are readily available in all sections of the country and may be purchased under standard specifications that insure uniformity.

Quarries and Quarry Products

Air-Driven Rock Drills Have Helped This Industry to Attain Its Present Large Proportions

By N. S. GREENSFELDER

THE oldest known quarries in North America are those near Rawhide Buttes, Wyo., from which an unknown prehistoric people secured the material used by them in the manufacture of their implements of war, as well as those employed in their domestic life, and for hunting. Flint implements by the thousands have been found there, and some of those are unlike any others ever discovered elsewhere. Three-cornered granite wedges, together with stone mauls, furnished the means by which the flint was broken down; and by patient work, the flint was then fashioned into the kind of implement desired.

So much for the past, when primitive man made use of implements of the crudest sorts produced from Nature's raw materials. Since that time, in the centuries gone, the inventor and the engineer have devised ways and means that have profoundly altered the methods and the facilities once employed to detach rock from its geological cradle. Few of us are aware of the present magnitude of what might broadly be termed the stone industry, that is to say, that field of work which provides us with stone for all sorts of purposes—some for building, some for monumental use, some for paving, and a vast deal for roadbuilding, concrete, and for other services too numerous to mention here. All that might be said now, as indicative of the volume of the business, is that in 1924—the latest period for which we have authoritative figures—our quarrymen produced a total of approximately 103,184,120 short tons of stone, valued at $161,870,113.

The stone industry in this country began with the utilization of boulders and cobbles in Colonial Times, and was confined almost exclusively for many years to the building and the monumental trades. Limestone was quarried for burning lime and for fluxing the small quantity of iron then mined. Granite paving blocks were not employed until 1840; and the use of crushed stone, though demonstrated by Macadam about 1820, did not make much headway until after the Civil War. Other uses of stone—particularly of limestone as a chemical reagent, and of dolomite and quartzite for refractory products—are of more recent origin.

Systematic granite quarrying began in 1825 as a result of quarry operations in Quincy, Mass., for the material utilized in constructing the Bunker Hill Monument. With the steady expansion of the country, the demand for quarry products grew apace. The production of Portland cement, which had been of almost negligible importance up to 1890, began to increase rapidly, and reached an annual output in 1925 valued at $278,524,100.

Limestone is today employed in a diversity of ways and for many purposes. Briefly, it is one of the principal materials required for the manufacture of Portland cement; it is used in the form of cut or dimensional stone for building; and limestone is essential in the smelting of iron ores and other metals. When burned, limestone is utilized in making mortar and chloride of lime; and it is employed in the manufacture of gas, soap, and sugar. In fact, lime plays an important part in various branches of the chemical industry; and, finally, lime is required to sweeten the soil and to make it fit for agriculture.

Basalt and related rocks, which are often popularly termed trap rock, are very widely used for roadbuilding purposes. This group of rocks, which includes basalt, diabase, and some other dark igneous rocks that are very

Putting horizontal holes in the face of a limestone quarry with a "Jackhamer." Because of its lightness, this type of drill is as adaptable for the drilling of horizontal holes as for vertical holes.

Getting out blocks of marble by the plug-and-feather method. In this work, the holes must be in alignment, and this is assured by mounting the drills on a quarry bar, as illustrated. A bar of this type was used when drilling the lines of horizontal holes in the face of the quarry.

similar in mineral composition and physical properties, contributed a little over 8 per cent. to the value of all the stone produced in the United States in 1924. During that year the sale of those rocks amounted to almost $14,679,523; and the stone was utilized for building purposes, for paving blocks, rubble, rip-rap, crushed stone for railroad ballast and concrete aggregate, and in certain papermaking machinery. During the World War, when certain Government yards on the Atlantic coast were constructing concrete ships, the variety known as vesicular basalt was found to produce an aggregate especially suitable for the purpose because of its light weight.

Sandstone is composed of mineral grains smaller than pebbles cemented together more or less firmly. There are many different kinds of sandstone—such as quartzite, ferruginous sandstone, micaceous sandstone, arkose, flagstone, freestone, ganister, bluestone, redstone, and brownstone. Sandstone suitable for the building trade exists in almost every state in the Union; and, because of its durability and its range of colors, is finding steadily increasing favor in this department of industry. Nowadays, many edifices are constructed entirely of sandstone, which is used both on the exterior and the interior of buildings, and it is also popular as a trim. The material may be sawed or cut into building blocks either in the form of even course stones or broken ashlar. Heavy blocks of standstone are often utilized in the rearing of bridges.

Large fragments of sandstone having many imperfections make good rip-rap for breakwaters, etc., while rubble—a term applied to stones each of which has one good face—is suitable for retaining walls. Certain crushed sandstone may serve as a concrete aggregate, while the variety known as ganister, when ground, goes into the making of refractory silica brick. The field of usefulness of this adaptable material is such a wide one that all its applications cannot be gone into here. Suffice it to say that it is made into grindstones, paving stones, flagging, curbing, steps, sills, etc., etc. In 1924, a total of 3,894,690 short tons of sandstone worth $10,142,099 was produced in the United States, and of this amount 3,550,530 tons were used for architectural purposes.

Granite is an igneous rock—that is to say, it was formed by the slow cooling of molten magma within the earth's crust. This slow cooling, under great pressure, accounts for its coarse, crystalline structure. Since the time of the early Egyptians, granite has held its position as an important building stone. It is usually harder to drill and to tool than some other building stones, but it is therefore also stronger than they are and generally more resistant to weathering.

Compressd air equipment and explosives are now used in most quarries in drilling and blasting out granite. However, where dimensional stone is cut it is the practice either to employ the plug-and-feather method or the still more modern hammer-drill method of channeling—that is, drilling and broaching by the aid of air-operated rock drills mounted on quarry bars. There is usually a big demand for good grades of granite in this country—the largest production within recent years being that for 1923, when 7,300,130 tons were quarried. The 1924 output amounted to 6,883,860 tons, valued at $28,772,161.

Shale and slate are also obtained by quarrying. Immense amounts of these materials are used in combination with limestone in the manufacture of Portland cement. Usually, the location of a cement plant is dependent entirely on the existence of these substances within easy reach of one another and in sufficiently large quantities to assure a supply for years to come. Slate, as most of us know, is also extensively employed as a roofing material, and for making billiard-table tops, electrical switchboards, flooring, mantels, blackboards, school slates, and many other commodities. Just how much of this material is required in this country can be appreciated when it is known that the slate sold at the quarries in 1924 was valued at $11,816,000.

A very interesting variety of shale, of which there are enormous deposits in Colorado and in Utah, is the so-called oil shale—from which oil can be recovered by processes of distillation. However, as the processes conceived in this country are as yet in an experimental stage, the great oil-shale deposits of the West are still awaiting development. In Scotland, the recovery of oil from shale has been carried on successfully for more than 70 years. One of

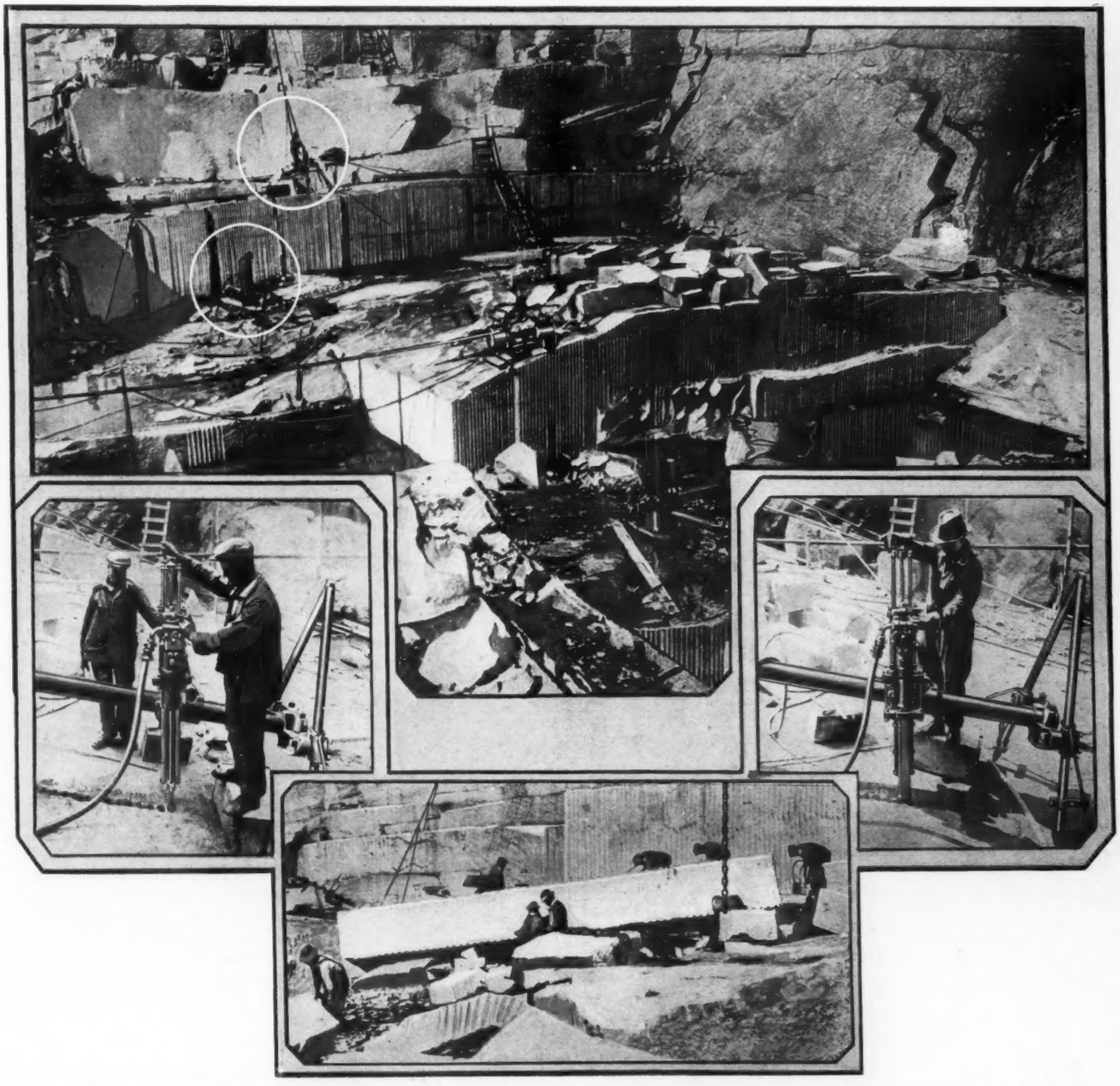
Mounted in this fashion, each of these "Jackhamers" drilled 288 linear feet of hole in Tennessee marble in six hours.

the by-products of this industry is ammonium sulphate, a fertilizer that is much in demand.

Clay may be defined as an earthy substance, consisting of a base of kaolin, mixed with various impurities. It usually shows plasticity when wet, which permits it being molded into any desired form that it retains when dry. It is, therefore, an article of great value in the plastic arts. A variety, called fire clay, will resist very high temperatures, and is therefore adapted to the manufacture of all kinds of refractory materials. Another variety, termed paper clay, is used as a filling for paper. This clay is of fine texture and white in color.

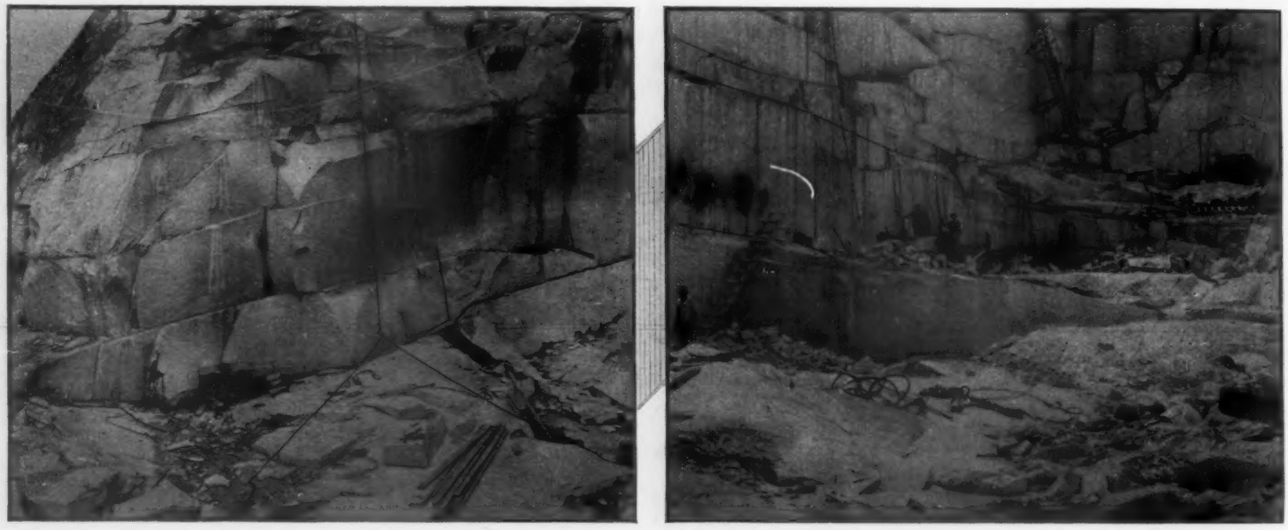
Gypsum is a hydrated calcium sulphate, which occurs in the form of rock gypsum, gypsite, and gypsum sands. The white grades, usually obtained from quarries of rock gypsum, are calcined and made into plaster. It also serves as a retarder for Portland cement, and as a base for certain paints; and a variety called alabaster has long been utilized for ornamental purposes and for molding statuary.

Talc, with which women should be familiar as it is the base for talcum powder, occurs in highly crystalline rocks, such as schists and gneisses, and is sometimes associated with limestone. In some localities talc rock is mined by underground methods, but it is generally obtained from open quarries. The common massive form of talc is termed soapstone—one of the rocks that was most widely used by primitive man. Because of its softness, resistance to sudden changes of heat, and slow radiation it was at one time much in demand for cooking utensils. Even to this day, the housewife prefers her soapstone griddle; and it also plays a part in fireless cookers. Soapstone is usually quarried in large blocks and then sawed into slabs; and it is principally used in the manufacture of laundry tubs, laboratory tables, hoods, and tanks. The services performed by talc are too numerous to mention here: it is enough for us to add that it forms a base for fireproof paints and lubricants, acts as a covering for boiler and steam pipes, as a foundry facing and an electric insulator, and is employed for dressing leather, and in making dynamite.



Different phases of the operations involved in getting out dimensional granite by the hammer-drill method of channeling. Note how straight are the faces as a result of this system of drilling and broaching.

One of the outstanding advances in the field of quarrying within recent years is the use of



Sections of a granite quarry, where dimensional stone is cut, before and after the adoption of the hammer-drill method of channeling. Contrast the straightness of the face on the right—where "X-70" hammer drills and piston drills, mounted on quarry bars, are used for drilling and broaching—with the broken surface of the face on the left.

cordeau for firing the blasts. This type of detonating fuse is steadily gaining favor because it measurably increases the shattering effect of the explosive, proportionately decreasing the need of secondary blasting. Cordeau consists of a carefully drawn lead tube filled with trinitrotoluene. An extremely violent shock, such as that produced by a blasting cap, is required for its detonation. The average rate of detonation of cordeau is about 17,500 feet per second; and when it is placed alongside an explosive charge the entire column is detonated at a rate equal to that of the cordeau.

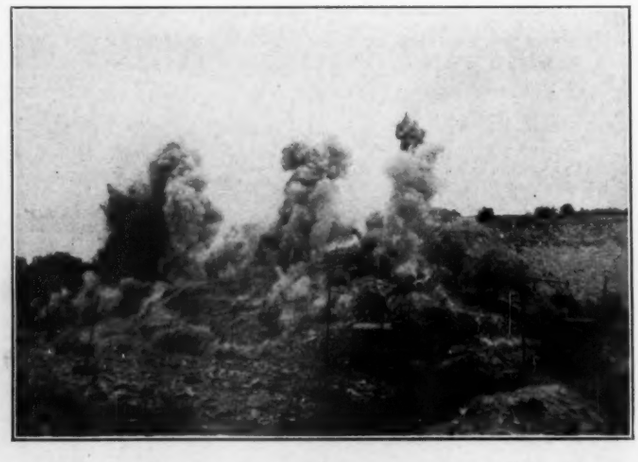
Many large quarries in California and other Western States have found the tunnel, or coyote-hole system of blasting to be the most economical one. This consists of driving small tunnels into the quarry face and of running crosscuts at right angle from the ends of the tunnels. Explosives are then placed in pockets in the bottoms of these crosscuts, after which the tunnels are backfilled with rock. All the charges in the crosscuts are fired simultaneously. The total charge is calculated to break out the rock at the base of the face—much of the overlying rock falling subsequently by reason of its own weight. This system of blasting is particularly well adapted to the quarrying of trap rock and of much of the limestone found in the Far West, but it is also used in some Eastern trap-rock quarries. One such blast, fired at a large quarry in California, brought down 356,000 tons of rock—more than 100,000 pounds of explosives being required to make that shot. The amount of money involved in a blast of this kind is so great that it is advisable to secure expert advice before driving the tunnels.

Compressed-air equipment, such as rock drills, play a very important part in quarry operations—the mounted "X-71" or hammer type of drill being well adapted for work of this kind. Where the bench method is practiced, "X-71's"—either wagon mounted for drilling in soft rock or tripod-mounted for drilling in hard rock—can be utilized to advantage where the face does not exceed 35 feet in depth. Deeper holes, required in other methods of quarrying, call for the use of well drills. The "Jackhamer" is principally employed in quarries to do secondary drilling—that is, for popholing boulders and pieces of rock that are too large for the shovels to handle.

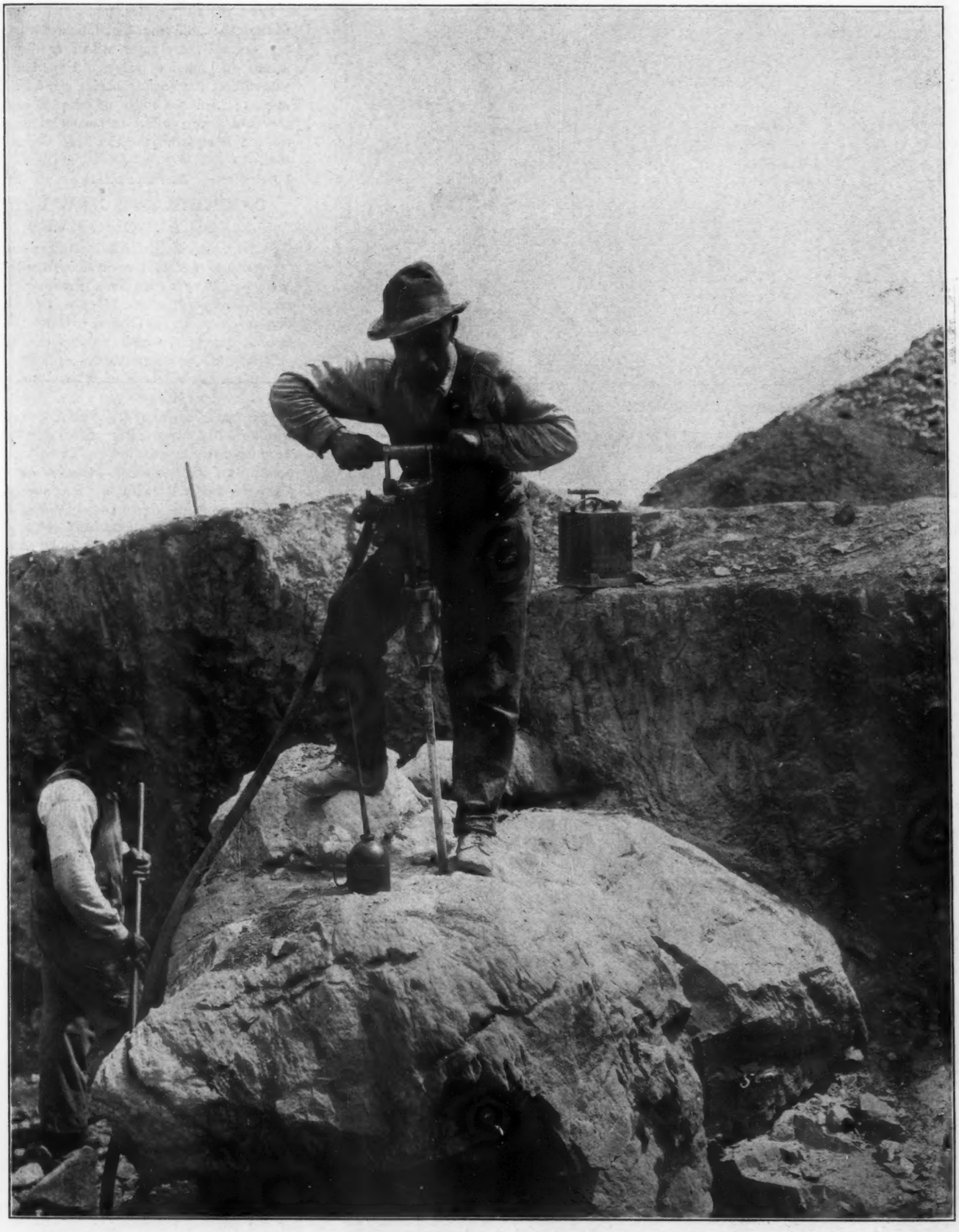
The "X-71" is a fast driller; and as it requires fewer drill steels than the "Jackhamer," for example, to put down a hole of a given depth, little time is lost in changing steels. With the "X-71" a footage of from 200 to 250 feet a day is not uncommon on continuous work. Holes for primary blasting are drilled to a depth of from 20 to 35 feet on from 5- to 7-foot centers; and when these holes are properly loaded, little secondary drilling is required.

At a Connecticut trap-rock quarry, tripod-mounted hammer drills were substituted for old reciprocating piston drills. It was considered a good performance if the operator of the piston drill put down 25 feet of hole during a 9½-hour working day. With the "X-71," however, it was possible for the operator to drill 96 feet of hole in fitchery ground in 9 hours—over three times as much work as he could do in the interval with the piston drill. This performance is all the more remarkable in view of the fact that the piston drill weighs

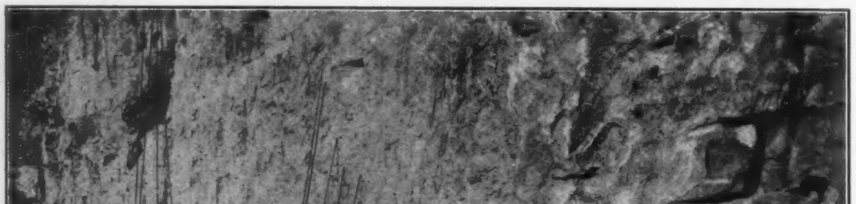
Breaking ground in a new quarry: loading the holes for the first blast.



Firing a big blast in one of the Portland Cement Company's quarries.



Getting rid of an obstructing boulder. Using a "Jackhamer" to put down block holes preparatory to loading and blasting.



Battery of DCR-23 "Jackhamers" at work on the bench in a limestone quarry. It is possible with these hand-held hammer type of drills to put down holes 25 feet deep.

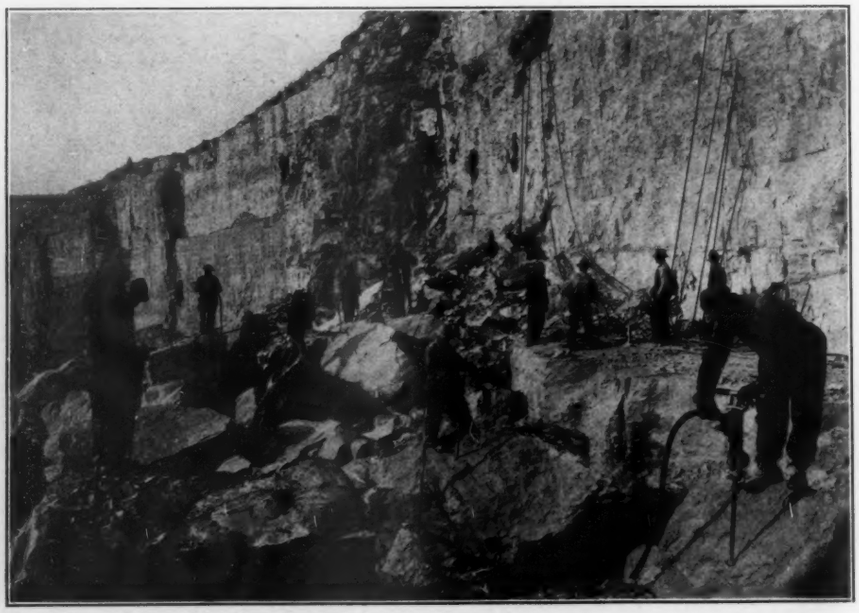
around 400 pounds, while the larger "X-71" hammer drill weighs but 210 pounds.

Drill-steel sharpeners are helping the quarryman in a number of directions, namely, they make better bits and thus bring about increased drilling speed; they produce steels of a uniform gage that are not apt to stick; they cut down the cost of sharpening; and they speed up the work so that there are always plenty of drill steels available. At one quarry, for example, the introduction of a sharpener saved the company the wages of two men. Since the sharpener was installed there has never been a time when there were not from 300 to 700 sharp steels available for immediate use, whereas when the work was being done by hand there were usually two or three machines standing idle, waiting for steels.

AIR-OPERATED THIRD-RAIL ICE SCRAPER

IN the shops of the Lackawanna & Wyoming Valley Railroad, Scranton, Pa., has been developed a third-rail ice scraper with which all the cars on the system are now being equipped for winter service. The mechanism is operated by compressed air, and consists of a 3½x4-inch air cylinder, scraper, and connecting lever. The scraper is made up of a ½x2-inch steel shaft, steel scraper head, and a set of four steel scraper blades set at an angle of 60 degrees, spaced ½ inch apart, and bolted securely to the head.

From the air cylinder, pipe connections lead to the cab; and, from his station, the engineer can operate the scraper whenever desired by means of suitable valves. Experience has proved that the scraper blades can be counted upon to give 200 miles of service, and that they are a very effective means of removing ice and sleet from the third-rail contact surface.



After a blast in a Virginia limestone quarry. Getting ready to pop hole the large pieces of rock so that they can be handled by the shovels. "Jackhamers" are being used to put down the drill holes.

CARBONITE—A NEW FUEL FOR AUTOMOBILES

THE problem of finding a substitute for gasoline for motor cars and trucks has been and is engaging the attention of many minds the world over. The newest thing in this direction is "Carbonite," the product of French engineers, which consists of charcoal held together by a suitable binder. The charcoal used may be made of waste wood, bark, etc.

It is said that the gas producer, required with fuel of this character, need be no larger than the average gasoline tank; and the fuel necessitates no changes in gasoline-engine design—the motor drawing in the charge of gas resulting from the distillation of the charcoal. In a recent test, a Mack truck—weighing 5 tons and carrying a load of 7 tons—made 100 miles on a consumption of 84 pounds of "Carbonite."

SUGAR HAS HARMFUL EFFECT ON CONCRETE

IN investigating two failures of concrete in districts in Egypt, where sugar is plentiful, it was found that the presence of sugar in concrete caused the mass to set very slowly, producing a very soft mix unfit for service. Sugar combined with lime forms what is known as saccharates—the strength of the concrete being lowered in proportion to the amount of saccharates contained in the mix.

In another case, in Denmark, certain parts of a concrete structure failed to set. Upon examination it was determined that the cement used at that particular stage of the work had been packed in sugar bags and therefore contained sugar to the extent of 2 parts per 100. This was sufficient to produce a mix that would not harden.

The Nugent marine oil filter, designed for the treatment of lubricating oil for marine Diesel engines, utilizes bags which may be removed for cleaning or renewal. The bag, enclosed within a steel case, receives the dirty oil from the engine and cleanses it on its way through. Should any bag become clogged, attention is immediately directed to the fact by a device that rings a bell or lights a red lamp. By means of by-pass valves the oil flow is then diverted past the filter, allowing it to be opened for the purpose of removing the bag. The dirty bag is subsequently turned inside out and cleaned either by washing or with compressed air.

Compressed Air Aids in Conquest of Insect Pest

By GAIL MARTIN

NEW honors redound to compressed air, for it has aided indirectly in conquering an insect pest that for several years past has threatened to ruin the cotton industry of the South. Compressed air was not used in the manufacture of the insecticides that actually did the work of destruction, but it did perform an important function in mining the ores in western Utah from which the insecticide—calcium arsenate—was made. It was in the development of a mountain of poison, a mountain of arsenic, in the Gold Hill district that compressed air did signal service for the cotton industry.

Visualize acres and acres of cotton, green and thriving under the soft, southern sky—an atmosphere of peace and the promise of plenty. Yet, millions of gorging insects are at their work of destruction and, over night, the vast green carpet fades—desolation meets the eye. The planters suffer a loss of millions of dollars!

In Utah, 45 miles south of Wendover, Gold Hill rears its seared and blackened peak. This arsenic deposit is the largest and probably the only one of its kind in the world. Because Nature made it an arsenic rather than a precious-metal mine, the Western Utah Copper Company has found the property unprofitable as a producer of copper, gold, and silver ores. The story of Gold Hill is one of vicissitudes not uncommon in the history of mining camps.

As early as 1869, the camp was organized. Several smelting and milling plants were built at various points in the Deep Creek district, and minerals worth more than $250,000 were produced. But in working the ore bodies—consisting of the contact replacement type—it soon became apparent that the miners, who had come to this region of barren mountains and shifting sand in search for an El Dorado, had been tricked. No large bonanzas were discovered. Mining languished until 1909, when the Western Utah Copper Company acquired the Gold Hill Mine and began the development of large masses of low-grade copper-silver-lead oxidized ore. As a result of this activity, the Deep Creek Railroad was built—a branch line extending into the district from the Western Pacific at Wendover. Several slumps occurred during ensuing years; but now, owing to the increasing demand for arsenic in fighting the boll weevil, interest has been revived in the camp's mineral resources, which include arsenic, gold, copper, zinc, lead, silver, tungsten, and bismuth.

Although one other great arsenic deposit has been developed in the district, the Gold Hill Mine, by reason of its size and the activity that centered about it a score or more years ago, is perhaps the most interesting. Gold Hill's jagged, concave mass consists of limestone, quartzite, and shale intruded by quartz monzonite. From the surface, thousands of tons of ore have been shipped, as is evidenced by the glory hole at the crest of the mountain that is 175 feet long, 80 feet wide, and 60 to 100 feet deep.

The mineralization of the Gold Hill Mine increases rather than decreases with depth, as is so often the case with deposits that outcrop strongly on the surface. On the 300-foot level, the ore body—a pear-shaped chimney of mineral replacing the marbleized limestone—measures 150 feet long and 100 feet wide; on the 700-foot level, it is 290 feet long and 60 feet wide;

Top, left—Compressor and enginehouse on the property of the Western Utah Copper Company, with the Great Salt Lake Desert in the background. Right—Blenk Gold Hill, America's largest arsenic deposit. Bottom, left—Gold Hill Mine and camp in the barren Deep Creek district of Utah. Right—Another view of the Gold Hill mining camp, which was organized in 1869.

and on the 900-foot level, it is 290 feet long—the width averaging 25 feet. The ore on this horizon carries from 30 to 35 per cent. arsenic—a phenomenally high arsenic content.

The ore body, as far as is now known, exceeds both in bulk and in height the 41-story Singer Building, in the City of New York. This building rises to an altitude of 612 feet. It is only by contrasting the deposit with something that can be visualized that the real proportions of the ore body can be grasped. Even so, the dimensions of this mammoth deposit are still a matter for conjecture, as the mineralization is stronger and more extensive on the 900-foot level than on those farther up, indicating that the workings will probably have to be carried hundreds of feet below the present lowest level before the base is reached.

A visit underground is of unusual interest. Above, below, in fact on all sides, lies the dry, rusty-brown rock streaked and stained a vitreous green, a pale yellow. This is the rock which, when converted into a dazzling white powder, is so fatal to the gluttonous boll weevil. On the 700-foot level, where an open stope has been left, the dull, rust-colored walls extend for a length of 100 feet and reach upward into impenetrable gloom for a height of 125 feet. Above this level is another cavern almost as large. Picturesque, indeed, are these man-made caves, at the bottom of which can be seen the gleaming, amber lights of the miners who, gnome-like, toil in the depths—their lamps casting grotesque shadows on the walls.

This little mine—little from the standpoint of total amount of work done and the comparatively limited footage that has to be run to develop enormous tonnages—is in a position to control the arsenic market of the world. In other words, were all other sources to fail, Gold Hill could supply the total demand for years to come. But this is not the only arsenic-producing property at Gold Hill.

The United States Smelting, Refining & Mining Company, which purchased the Last Dollar group, has opened up an immense reserve in the district. Already, the company in question has sunk a shaft on a narrow seam of scorodite; and, almost without any change, at a depth of 30 feet, a massive body of arsenopyrite was entered. A tunnel has been run, and the vein sunk upon to a depth of 200 feet. On this horizon has been located an ore body that is 100 feet wide and contains about one-half scorodite and one-half mispickel. To work the property, the United States Smelting, Refining & Mining Company has recently installed semi-Diesel, oil-burning engines and a belt-driven compressor. This deposit promises to develop into as large a one as that of the Western Utah Copper Company, so that the camp can now boast two of the world's biggest arsenic producers.

Potassium can be made to pass through the walls of a sealed glass tube in order to deposit the metal on the inner surfaces. A bulb so lined may serve as a photo-electric cell and can be used to transmit photographs by telephone or by radio.

WIND PUTS HEAVY LOAD ON TRANSMISSION TOWERS

IN building high-tension power lines, engineers must take into account not only the weight of the wires but also the pressure of the wind exerted against these wires. Just how great is this wind load was brought out in the case of a new high-tension line that crosses the Sacramento River.

This line has a span of four-fifths of a mile, and the wires suspended between the transmission towers weighs 69,000 pounds. To take care of wind pressure, the supporting towers—410 and 459 feet high, respectively—had to be built strong enough to carry an additional burden of 14,400 pounds.

"JACKHAMER" SETS THE PACE

UNDER this heading appeared the following interesting item in the *South Africa Mining & Engineering Journal*:

"An outstanding performance was recently accomplished in a Witwatersrand mine stope by two Ingersoll jackhamers, type DCRW-23. In 22 shifts these machines between them drilled 1,485 holes in a 32-inch stope—an average of 33.7 holes per machine shift, as a result of which 413.5 fathoms (2481 feet) of ground were broken. This represents an average per machine shift of 9.4 fathoms. To appreciate this latter figure it is necessary to realize that when the first machines of the light, hand-held type were set to work on these fields, under present methods, the aim of the mine management was four 3-ft. holes with a machine which could be operated and handled by one native. This, they estimated, would give .4 of a fathom per machine shift. This performance has, in a few years, improved no less than 23½ times.

"One is led to inquire why the record was taken over 22 shifts, and not over a calendar month. The reply proves to be that the 22 shifts were spread over a month, but that by the middle of the period the stope was so much behindhand as regards lashing and timbering that a halt had to be called in order that the broken ground might be cleared out and the roof supports advanced sufficiently close to the face. Thus the voracious little machine is proved to be setting a pace in advance of the capacity of other departments, as at present organized; and it is clear that further marked improvements in breaking efficiency on the Rand are still to be made.

"In the present case, the performance of the two machines—under one miner—has been averaged, but the machine operating on the south face, having a freer run, was responsible for 235.5 fathoms, an average of 10.7 per shift. By speeding up and cheapening the breaking of ground, and by permitting the reductions in stoping width which are so marked as to seem incredible to some of our overseas critics, the jackhamer has contributed to an extraordinary degree to our mining efficiency, and so far we have not by any means seen the end of the story or the full results that are possible."

NEW METHOD OF DRAINAGE FOR QUARRIES

THE problem of drainage in quarries is often a troublesome if not a costly one, especially in the case of those that are in northern sections of the country where the formation of ice in the wintertime aggravates matters. Flowing water is apt to make working conditions uncomfortable at any time; but danger is added to the situation when sheets of ice overhang walls and ledges. Quarry operators should therefore be interested in a bulletin, recently issued by the United States Bureau of Mines, that covers this subject and that suggests a remedy—a new method of drainage that has been tried out and proved to be satisfactory.

According to *Stone*, the system is in use at a slate quarry in Pen Argyle, Pa., where it has reduced the flow of water over the quarry face to a mere fraction of its former volume. To quote: "In a carefully selected position outside the quarry, and some distance back from the face in the direction from which the water naturally flows toward the quarry, a 6-inch well-drill hole is sunk to such a depth that it pierces the water-carrying beds. Charges of dynamite are then fired in the hole in or near the water-bearing strata. Thus the rock is so fractured that water readily flows toward the drill hole. A pump is then installed to remove the water from the hole. Thus the drill hole taps the joints and seams through which the water travels, and intercepts the flow before it reaches the quarry face."

SAND BLAST REMOVES PAINT FROM WICKER CHAIRS

ANYONE who has ever tried to remove paint from a wicker chair knows how troublesome and almost impossible it is to clean the surfaces of the interwoven reeds by the methods usually employed to do work of this kind. Realizing this, Mr. Arthur Redderson, superintendent of motive power of the Indiana Service Corporation, decided that something else would have to be tried if the wicker chairs used in certain of their buses were to be cleaned and repainted. And thus was conceived another use for the sand blast.

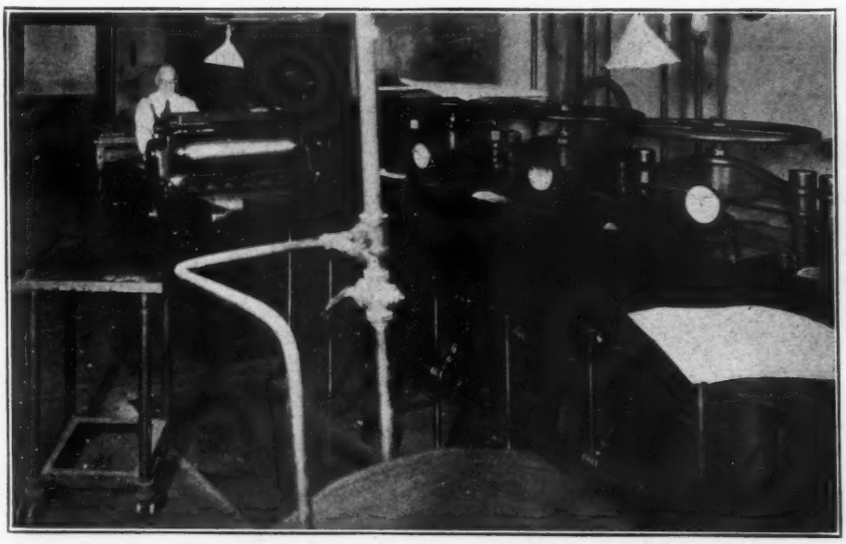
To prevent cutting the reeds, the sand was applied at a fairly low pressure—that is, at 45 pounds to the square inch, and care was taken not to keep the blast on one spot for too long a time. To quote Mr. Redderson: "The method worked out well and much time and trouble were saved. I believe the sand blast, carefully handled, will work well for removing paint from cane seats." The company in question has also made use of the sand blast to remove paint from canvas roofs.

A strike of comparatively high-grade copper ore has been made near Elgin, New Brunswick, according to a report received from the American Consul at St. John, Canada. Shafts have been sunk at different points throughout the prospected area, which covers two square miles, and in each case copper ore has been discovered. Official assays show values running as high as $15 per ton.

How Compressed Air Is Used To Advantage In a Newspaper Plant

By H. W. COOPER*

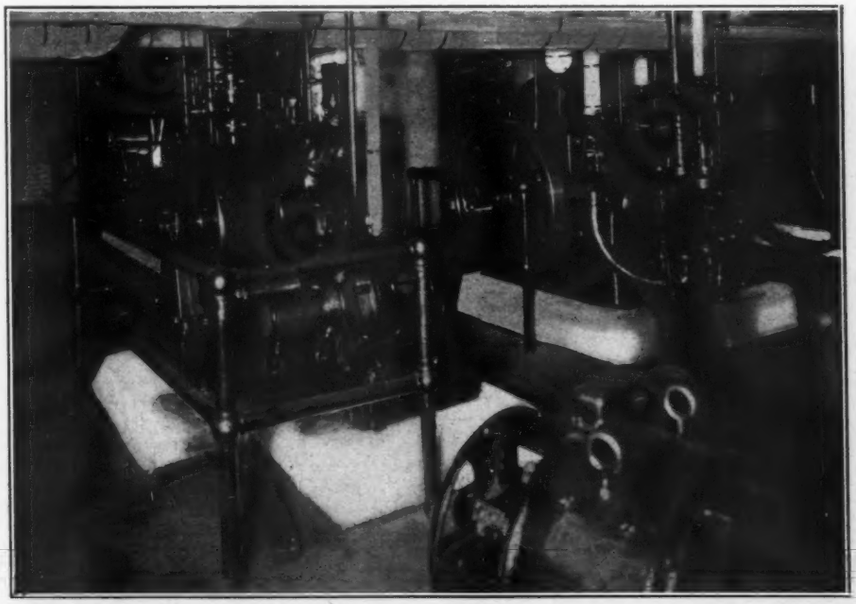
IN this age of comforts and conveniences, how many of us give a thought to the mechanical forces that toil ceaselessly so that we may not be deprived of the use of the telephone or the electric light, and that our breakfast may not be spoiled by the nonappearance of the morning paper. Yet back of the "central" or the boy that delivers our newspaper there is a vast array of machinery that is so skillfully handled that we are rarely reminded of its existence through a failure of the things that we have grown to depend upon.



Hoe steam tables, in the stereotyping room, that are operated by compressed air.

Take a modern newspaper plant, the *Manitoba Free Press,* of Winnipeg, for example. Down in the basement of that establishment there is a power plant large enough to supply the requirements of a small-sized town. This plant includes a battery of steam boilers, three motor generator sets with control boards, and steam centrifugal pumps for boiler feeding, circulation, etc. This steam plant is used as a standby in case of power failure, and is so arranged that a complete change from electricity to steam can be made in case of emergency within fifteen minutes. Besides, there is a compressor plant that furnishes the operating air needed for numerous purposes throughout the establishment. The amount of compressed air that is used would be sufficient to operate a small coal or metal mine to capacity.

Away back in the pre-automobile days, when the bicycle was a very popular means of locomotion, some ingenious mind in the office of the *Free Press* conceived the idea of using compressed air to inflate tires. This idea promptly took form: workmen were given the job of boring a hole under the sidewalk in front of the *Free Press,* and an air pipe was laid to the curb. That done, the *Free Press* erected the first "Free Air" sign to appear in Western Canada, and introduced a service that has since become universal. In fact, it is probably no exaggeration to say that the motorist of today hardly knows what the old hand pump looks like.



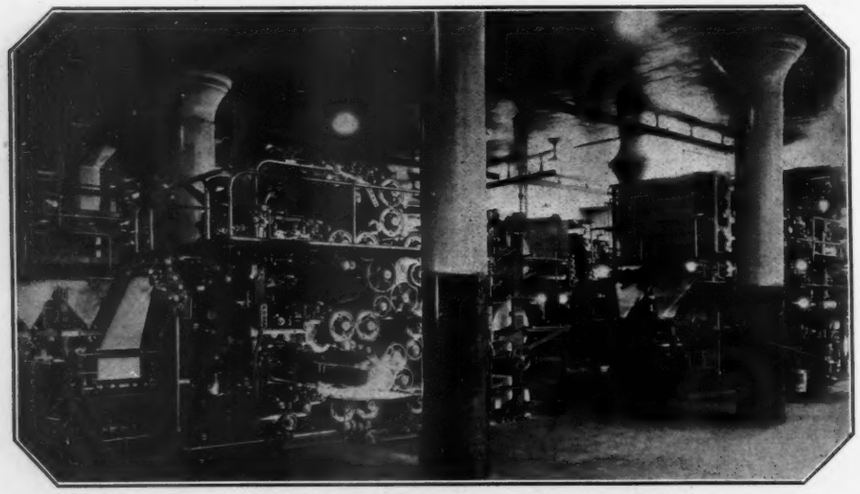
The three compressors that furnish the air used for various purposes throughout the plant of the Manitoba Free Press.

While this has no direct bearing on the use of compressed air in a newspaper plant, still it emphasizes the fact that where compressed air is available new uses for this flexible power medium will always be found. Today, compressed air is as necessary to the efficient operation of a modern newspaper or job-printing plant as steam or electricity.

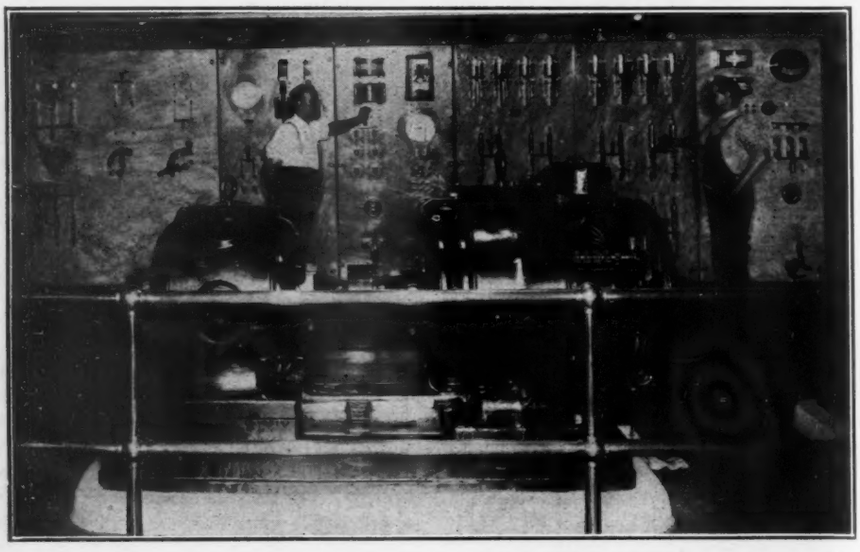
The *Manitoba Free Press,* from the time of its establishment in 1872 in a straggling village—when its equipment consisted of a hand press and its staff numbered five, has always been progressive. As the West developed, it built and rebuilt plants so as to keep step with that growth and to maintain leadership in the business that it had founded. In 1905, the *Free Press* moved into a fine new building that had been especially designed and erected for its occupancy. At that time the whole plant was modernized; and, among other equipment, there was installed an 8x8-inch air compressor. That was the beginning of the employment of compressed air by the *Manitoba Free Press.* In a short time, as new uses for this form of energy demanded more compressed air, the initial unit was reinforced by an Ingersoll-Rand 10x 12-inch machine.

By 1912 the business had expanded to such an extent that construction was begun on a steel-and-concrete structure—the sixth home of the *Free Press* and the largest and most complete newspaper plant to be erected up to that time in Canada. Into this new building the *Free Press* moved in the spring of 1913; and one of the first steps taken by the management was that of enlarging the compressed-air plant not

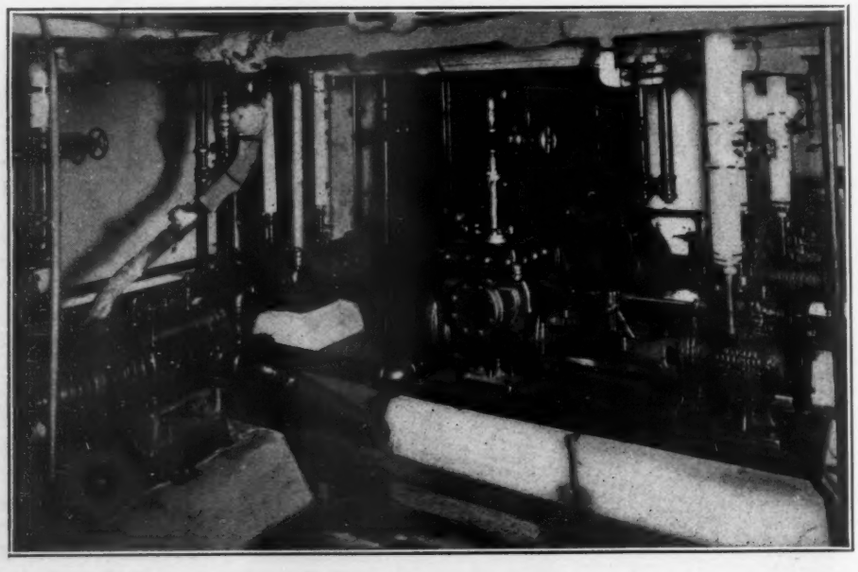
Mechanical Superintendent, Manitoba Free Press.



Corner of the press room where the Manitoba Free Press is published. Compressed air simplifies the work of keeping the intricate machinery thoroughly clean.



One of the three motor generator sets, with control board, that supplies electricity in the modern plant of the Manitoba Free Press.



Section of the engine room showing the steam- and centrifugal-pump installation and the pneumatic sewage ejector.

only to meet the extra load placed upon it but to make it possible to utilize compressed air throughout the building. There was installed a motor-driven compressor having a capacity of 150 cubic feet, together with a complete pressure distribution system —the whole pneumatic plant being so arranged as to give the greatest service and to insure operating efficiency. In this connection it might be said that years of experience proved compressed air to be indispensable to the efficient operation of the plant.

And now let us see just how much work compressed air is counted upon to perform in the different departments of the *Free Press*. To begin with, the necessary auxiliary water is supplied by an Artesian well that is 420 feet deep. This water is raised by an air-lift pumping plant installed in the engine room. Owing to the fact that the city's sewer mains lie above the floor of the sub-basement, sewage has to be raised for a distance of 14 feet. This work is done by two Priestman pneumatic ejectors, such as are now employed to advantage in many hotels and large office buildings. Jets of compressed air serve better than anything else to clean the motors and the generators in the engine room. In the garage, air is used in painting cars, for inflating tires, etc.

In the press room, compressed air is especially useful in cleaning the machines after the run is over. Waste and torn paper is thus quickly removed from the presses: work that would otherwise take much more time, aside from being laborious. Again, compressed air speedily disposes of the accumulations of minute fibrous shreds that are thrown off by the rapidly moving miles upon miles of newsprint fed between the rolls of the great rotary presses. In fact, owing to the difficulty of getting at the machines, compressed air is the only thing that can be counted upon to keep a place of this sort clean without wasting much time and at a moderate outlay. In the job department, jets of air also clean out the flat bed presses and other machines operating monotypes, etc.

Coming to the stereotype department, we find that air power is used in connection with Hoe steam tables, as well as for blowing metal particles and other fragments out of machines and motors. The hoist that carries the stereotyped plates to the press room is operated by compressed air. Air hoists are especially adapted to printing plants, paper mills, etc., on account of their simplicity, freedom from mechanical trouble, and elimination of fire risks.

The *Free Press* now has under construction the second wing to its main building, thus doubling the size of the plant occupied since 1913. This addition will house a new stereotyping room, to be equipped with the most modern facilities, and an up-to-date garage for the motor fleet maintained by the *Free Press*. In both of these departments compressed air will have important functions to perform.

IMPROVED AGITATOR FOR MIXING CEMENT

IN the manufacture of Portland cement by the wet process, a difficult problem in agitation is encountered. The constituents of the cement are first brought together in the form of a slurry, which consists of a mixture of finely ground limestone, finely ground marl, and water—the latter being about 33 to 40 per cent. of the total weight.

The constituents are first placed in a correction basin in approximately the required proportions. Then samples are taken and the necessary corrections made to give the desired composition. When the slurry is satisfactory it is sent to storage agitators, where it is kept under constant agitation for the purpose of maintaining absolute homogeneity throughout the entire mass. It is necessary to maintain the same thorough agitation while the storage basin or slurry mixer is being filled and while it is being emptied. This presents an exceptionally difficult mixing problem to handle mechanically because of the fluctuation in pulp depth in the mixer.

Three general types of agitators have been used—that is, mechanical agitators, air agitators, and a combination mechanical and air agitator. The mechanical agitators consume a great deal of power; and while they give excellent mixing in a horizontal plane they do not cause an appreciable circulation vertically. This results in the slurry becoming stratified and, therefore, not homogeneous. Air agitation alone does not prevent the coarser particles of material from collecting on the bottom of the mixer at points where the air jets are not effective. Also it is expensive to operate. A combined mechanical and air agitation process, developed by the Dorr Company, overcomes these objections in that it insures homogeneity at a low cost.

This machine consists of a set of rotating arms to which plows are attached. These are driven from a central shaft and rotate in a plane parallel to the bottom of the mixer. The function of the rakes is to scour the bottom of the tank and to sweep any settled coarse material to the center of the tank where it can be again picked up and mixed through the mass. Around the vertical shaft and resting on the rakes is a cylinder extending upward about one-third of the distance to the maximum slurry line. On the arms are a number of short cylinders which are likewise rigidly attached to the arms and rotate with them. A group of compressed air pipes are brought down the central shaft, one being attached to each cylinder. The central cylinder acts as an air lift which raises the settled solids, that are brought in by the plows, to the upper strata of the tank. The small cylinders act simply as air jets to increase the agitation between the center and the periphery of the tank; and they are effective due to the fact that they are continually moving.

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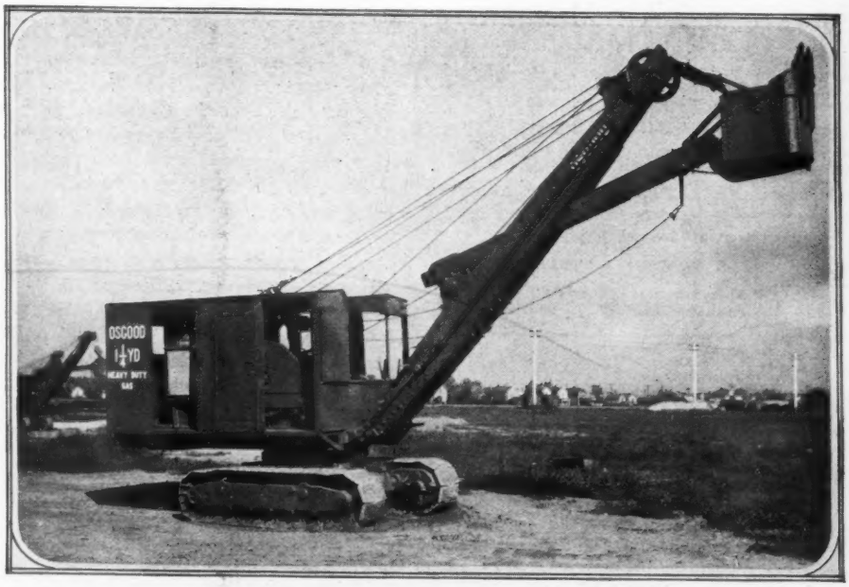

The new heavy-duty gasoline or electric shovel.

NEW POWER SHOVEL FOR HEAVY WORK

THE Osgood Company, of Marion, Ohio, announces the addition of a 1¼-yard gasoline or electric shovel to its line of excavating machinery. The machine is similar to the 1-yard model except in respect to the power plant provisions. It is designed for heavy duty, and its strength and rigidity are featured by the makers.

Where gasoline is used, the engine is of the 6-cylinder type, developing 75 horse power. Motor equipment is specified for the use of either alternating or direct current. Power is transmitted through a silent chain drive, which is claimed to have a mechanical efficiency of 98 per cent.

The shovel is of the full-revolving type and is mounted on a continuous tread truck, with tread belts 24 inches wide. The machine is readily convertible into a crane by changing the boom and fitting hook-block or clamshell buckets. It also can be made to serve as a dragline excavator or as a back hoe.

A RATTLING GOOD JOB.

By kind permission of London Opinion.

MOTOR FUEL FROM LIGNITE

FOLLOWING successful experiments with the Bergius process for distilling lignite, a scheme is on foot in Germany to produce motor spirits from lignite on a scale that will make that country independent of gasoline from foreign sources.

A syndicate has been formed, and a big factory is to be erected at a cost of $2,500,000 in the vicinity of Merseburg, in the heart of the brown-coal district. The factory will have an annual capacity of 90,000 tons of motor spirits, 120,000 tons of petrol, and 3,000 tons of lubricating oil, besides residues of coke and combustible gases.

At present, about 100,000,000 tons of lignite are mined in Germany yearly, but the prospects are that when the new plant is in operation this output will have to be doubled.

On September 1, 1925, from a report issued by the National Electric Light Association, the productive capacity of power plants and of prime movers in industrial establishments in the United States reached the 50,000,000-horse-power mark.

Compressed Air Magazine

—Founded 1896—

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EDITORIALS

The Season's Greetings

ONCE more we wish our readers all possible happiness and success in the New Year.

When broadcasting our accustomed annual greeting a year ago, we expressed our appreciation of the friendly approval of our readers—remarking at the time the continually increasing number of names on our mailing list.

It is a source of much gratification now to mention that during the past twelve months we have added substantially three thousand more names to the list of those that receive the Magazine. This is the best evidence that we are reaching a continually widening circle of readers whom we are earnestly desirous of serving.

It is our hope that we may be of still greater use to our friends in 1927; and to this end we ask their fullest coöperation.

VELOCITY OF LIGHT FOUND TO BE SLOWER

AFTER something like twoscore years of intermittent research, Prof. ALBERT A. MICHELSON has determined by the aid of special facilities that light travels through space at a rate nearly 40 miles slower each second than has heretofore been the accepted belief among men of science. The fact that light speeds on its way at a velocity of 186,284 miles a second instead of at 186,324 miles a second will not make the least bit of difference to the vast majority of us; and Professor MICHELSON, himself, says that the new figure will probably have little if any material significance. However, the fact that light does travel at a slower pace instantly extends the boundaries of the universe; and a difference of 40 miles a second becomes an imposing figure when one measures the remoteness of planetary systems by millions of light-years, as is the case with some of those planets that may have ceased to exist even though light generated by them in the ages gone is still journeying toward our range of vision.

Professor MICHELSON says that he undertook the almost endless computations and protracted experiments in a spirit of fun. That is to say, he found diversion in that form of mental exercise. It is this spirit of the researcher, the seeker after the truths of pure science, that unravels Nature's secrets and makes it possible for man to forge confidently forward where previously the best he could do was to grope. Furthermore, the scientific fact of little moment today may be of outstanding value tomorrow.

Professor MICHELSON, after he had brought his work to a climax, arrived at the figure that he now offers as the closest determination yet made of the velocity of light by checking up the speed of light over an interval of 22 miles between Mount Wilson and Mount Antonio, Calif. That base line had been measured with the utmost possible accuracy, and this accuracy, so we are told, had not previously been equaled in measuring any other base line. The whole story of this work has not yet been told, and it will prove an interesting one when told. The point worth emphasizing now is that it is this spirit of inquiry, this insistence upon precision, that gets us forward in all departments of life where the goal is excellence.

STARTING THEM RIGHT

A TOTAL of more than $20,000,000 was deposited by school children of America during the past school year. This money represented the savings of boys and girls to the number of more than 4,000,000—all the result of an organized effort to induce the school children of the United States to save rather than to spend their spare pennies.

The American Bankers' Association stands back of this campaign of thrift, which is an outcome of the spirit of economy which was encouraged in so many ways during the period of the World War. A significant feature of the last year's savings is that the deposits were 20 per cent. greater than during the year before. The number of schools with savings systems increased nearly 12 per cent., and the number of participating pupils was augmented 18.5 per cent. Surely, the showing is suggestive of an awakening sense of the meaning of money on the part of youthful Americans.

Quite apart from the material value represented by the sum or sums saved, there are other benefits that are scarcely less valuable. For instance, the youngsters acquire practical knowledge of how to make and to cash checks, how to deposit money, and how to use that money in buying securities. Furthermore, the boy or girl that saves in this way learns to so regulate his expenditures in relation to the funds at his disposal that he may practice restraint or self-denial—thus laying a lasting foundation stone in the upbuilding of character.

There are hundreds of thousands of mature persons in this country that would be far better off today had such a system for the encouragement of thrift existed when they went to school.

WANTED: A MERCHANT MARINE POLICY

REGIONAL hearings have been held during the last few months by members of the United States Shipping Board in an effort to bring out essential facts that may serve in guiding Congress in the near future in developing some definite policy regarding America's merchant marine. The opinions of business men, shippers, manufacturers, farmers, and others, either directly or indirectly concerned in the solution of this problem, have been sought; and this information will be laid before our national legislators.

There was a time when the building of ships concerned only a limited department of our industrial life. That was when the merchant ship was of comparatively simple construction and subscribed to rather modest demands. Today, power-driven merchantmen—especially the large freight or passenger-carrying craft—draw upon many and diversified industries in providing for their complex structures and equipment. Thus, factories and plants are contributing to these vessels in ways that those plants and factories did not do in times gone. This is mentioned merely to stress the fact that the question of a commensurate merchant marine touches our economic life in well-nigh endless ways.

But quite apart from this aspect of the subject is that other angle which has to do with our national self-sufficiency, possibly national defense. One has only to recall the situation confronting us in the first few months of the World War, when foreign ships—especially those flying the British and the German flags—were either withdrawn from service or commandeered to carry essential commodities required by one of the belligerents. American exporters, American manufacturers, American farmers were left in the lurch, and bottoms for the transportation of their commodities were nearly as scarce as the proverbial hen's teeth. All sorts of abandoned hulks and limping craft of many kinds were rehabilitated and sent to sea again. We all can remember the nearly fabulous prices paid for those vessels, and we can still recall how many of those cripples went

to pieces when battered by stormy seas. And then, there was that humiliating situation of a sorry lack of transports, flying the American flag, when we decided at last to send troops to the battlefields of Europe.

These various facts are mentioned now not for the purpose of reviving painful recollections but to bring home to all of us how important it is that America should have a merchant marine large enough and modern enough to carry the major part of its exports and its imports—in short, be in a position to foster its foreign trade through the agency of its own ships, and be in a position to take care of its own producers should strife again withdraw alien craft from overseas service. We can never have a suitable American merchant marine unless the nation as a whole is alive to what such a fleet would and could mean to our common prosperity and security.

THE CANDY INDUSTRY

THERE was a time within the memory of some millions of us when the candy shop in the neighborhood or the town was among the least conspicuous of the local businesses. Candy was a luxury that stood forth in all its glory during the Christmas holidays; and throughout the rest of the year it contributed to the comparatively modest hankerings of children for the most part. But how different is the situation today! A few details will suffice to make apparent the startling transformation that has taken place in the candymaking industry.

The *New York Sun* has summed up the salient points of the change in this fashion: "Until about 1845 each candy dealer made his own goods by hand. In that year SEBASTIAN CHAUVEAU, of Philadelphia, invented a revolving steam pan for cooking candy; and in 1846 OLIVER R. CHASE, of Boston, perfected a machine for turning out candy lozenges. By 1853 there were 383 large candy factories in the United States, employing 1,733 workers and producing $3,040,671 in goods. In 1909, there were 1,944 large establishments, of which 12 were producing each at least $1,000,000 worth of goods a year. In 1923, some 2,000 confectionery plants produced goods valued at $366,256,000.

"In 1866, when the candy industry was comparatively young, the per capita annual consumption of sugar in the United States was 30.5 pounds, and the total represented 22.5 per cent. of the world's production of sugar. In 1923, the per capita annual consumption had risen to 106.4 pounds, and America consumed 29 per cent. of the world's production!"

Machinery of many kinds, power in various forms—compressed air being a conspicuous aid, refrigeration, and mechanical means of preparing, packing, and even of vending the wares have brought about amazing alterations in standardizing the products and in turning out candies of excellent quality at prices that put good candies within the reach of every purse. Whether the consumption of so much candy is desirable—considered alone from the point of view of health and of physical effect, there is no denying that America's sweet tooth is yearly developing a keener appetite.

SAM NOBLE, ABLE SEAMAN. An autobiography of 305 pages with a foreword by Rear Admiral A. F. Davidson, Royal Navy. Published by Frederick A. Stokes Company, New York City. Price, $3.00.

SAM Noble's book is a story of life 'tween decks in the "seventies," in the British Navy. So much has been done to transform the fighting ship and life in naval vessels since the "seventies" that we of today cannot appreciate the changes unless we have the background of the past as a contrast. The author has preserved the flavor of the sea in the days of the old sailing ship; and he carries the reader into far-flung ports in many climes. The book is entertainingly written and absorbing from beginning to end.

THE MODEL T FORD CAR, by Victor W. Page. A copiously illustrated book of 495 pages, published by The Norman W. Henley Publishing Company, New York City. Price, $2.00.

THE present work is the 1926 edition of a book first brought out in 1915 and which has undergone seven revisions since then. The Model T Ford car has been built with practically no important structural or mechanical changes for fourteen years; and during that time more than 12,000,000 Ford cars and trucks have been produced to meet the demand for them. The volume gives in similar detail mechanical facts concerning the Fordson farm and industrial tractor. Accordingly, the 1926 edition of the work should be of interest to a great many people.

AIRMEN AND AIRCRAFT, by Major Henry H. Arnold, U. S. Army Air Service. An illustrated book of 216 pages, published by The Ronald Press Company, New York City. Price, $3.50.

IN effect, the volume is a general introduction to aeronautics as we understand that subject today. The author was inspired to prepare the book because of a widely recognized need of technical information for designers, engineers, pilots, and students in this new field of service. The average reader will probably be most interested in the chapters that deal with aircraft and what makes them fly; commercial aeronautics; and aircraft of the future. Major Arnold has handled his subject well.

ELEMENTARY STEAM ENGINEERING, by E. V. Lallier, Professional Engineer, University of the State of New York. An illustrated work of 288 pages, published by D. Van Nostrand Company, New York City. Price, $2.50.

THIS is the second edition of the work, and the reasons for it are thus outlined by the author: "During the past few years many improvements have been made in engineering methods and apparatus. Methods of construction have been standardized, and economy and efficiency of operation have been greatly increased. Nevertheless, the fundamental principles of the subject remain unchanged; and the publishers feel warranted in placing before young engineers this new volume with the full confidence that, with its added and modern contents, it will prove a valuable aid in their profession."

BETTER CORRESPONDENCE, by W. C. Miller. A volume of 278 pages, printed by the Miller Publishing Company, El Paso, Tex. Price, $3.50.

IT need hardly be mentioned here that there is a crying need for better letters, better correspondence generally, in all departments of our business, commercial, and industrial life. Many books have been written to help towards improvement, and each work appeals to a larger or smaller number of readers. We believe that many persons whose business it is to dictate or to write letters will find Mr. Miller's book a useful guide in avoiding various difficulties and in putting their thoughts in plainer and more convincing language.

THE UNITED STATES OIL POLICY, by John Ise, Professor of Economics in the University of Kansas. An illustrated book of 547 pages, published by Yale University Press, New Haven, Conn. Price, $7.50.

THE present volume follows another work, the *United States Forest Policy*, written by Professor Ise six years ago; and the reason for the new book is in a general way based upon the broad principle of conservation outlined by the author in the work just mentioned. To quote: "The history of the United States is fundamentally a history of rapid exploitation of immensely valuable natural resources. The possession and exploitation of these resources have given most of the distinctive traits to American character, economic development, and even political and social institutions. Whatever preëminence the United States may have among the nations of the world, in industrial activity, efficiency and enterprise, in standards of comfort in living, in wealth, and even in such social and educational institutions as are dependent upon great wealth, must be attributed to the possession of these great natural resources; and the maintenance of our preëminence in these respects is dependent upon a wise and an economical use of remaining resources. Thus the question of conservation is one of the most important questions before the American people; and if the present study throws even a weak and flickering light upon that question its publication will be abundantly justified."

What Professor Ise has said about the conservation of our forests is equally applicable to the conservation of our oil resources, on which our economic welfare so vitally depends.

Cyclone Suction Sand Blast Nozzles, is the title of a pamphlet issued by The Direct Separator Company, Inc., Syracuse, N. Y. This pamphlet will probably be of interest to many persons using or contemplating the use of sand-blasting equipment.

The United States Bureau of Mines has announced the following list of new publications:

TECHNICAL PAPER 379. *Strength of Ore and*

Top Rock in the Red Iron-Ore Mines of the Birmingham District, Ala., by W. R. Crane. Price, 10 cents.

Gold and Silver in 1924. A general report by J. P. Dunlop. Price, 10 cents.

Cement in 1924, by E. F. Burchard and B. W. Bagley. Price, 5 cents.

Fluorspar and Cryolite in 1925, by Hubert W. Davis. Price, 5 cents.

Orders should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D. C.

EFFECT OF TEMPERATURE ON STEEL TAPES

A STEEL measuring tape, as most of us know, varies in length with changes in temperature. But just to what extent it is lengthened or shortened through expansion and contraction is not commonly known. In order to answer many inquiries for information on this subject, the Lufkin Rule Company, of Saginaw, Mich., wrote the following letter, which may be of interest to many of our readers:

"United States temperature standard for steel tapes is 68° F. The standard tension for a 50-foot steel tape, supported throughout on horizontal flat surface, is 10 pounds avoirdupois. The co-efficient of expansion of steel tapes, as determined by the United States Bureau of Standards, is .00000645 per degree Fahrenheit.

"This, we believe, you will understand means that such tapes change by that fraction of their length for each 1 degree change of temperature. This figures out to a difference in length of .00387 inch per degree Fahrenheit for a 50-foot tape. Putting this differently, the tape is longer by that amount for each 1 degree rise in temperature and shorter by the same amount for each 1 degree drop in temperature,"

HEAVY-OIL ENGINES FOR BRITISH AIRSHIPS

IN dealing with the subject of *Imperial Air Communications*, Sir Samuel Hoare, minister for air, incidentally mentioned at the British Dominions & Colonial Premiers' Conference, in London, "that the airships now being constructed at the Cardington Airship Station will be equipped with heavy-oil engines, these having been adopted in preference to gasoline engines in order to reduce the fire risk."

Shortly before Sir Samuel delivered his address, a Diesel type airplane engine, built by William Beardmore & Co., of Glasgow, underwent a successful 6-hour test. No details are yet available; but Lord Invernairn, the chairman of the company, is reported to have stated in an interview that with only six cylinders the engine developed 950 B.H.P. at 1,350 revolutions per minute on 15 per cent. less weight of fuel than the average airplane engine operating on gasoline.

The American people spend more than $130,000,000 in one year for Pullman accommodations. This figure does not include the railroad fares paid by those travelers.

It has been discovered, according to an announcement made by the United States Bureau of Mines, that the gases from iron blast furnaces can be made to yield a revenue. In other words, tests have shown that it is entirely feasible to recover alkaline cyanide from blast-furnace gases. In one case, where one-tenth of the gas was withdrawn, cyanide to the value of $104 was produced daily without adversely affecting the furnace.

The first refrigerator car to be used in China has made its appearance on the Shanghai-Nanking Railway.

An unsinkable fiber rope has been invented by a Hollander, according to the *Engineer*. A core of "foam rubber," which has a much lower specific gravity than cork, gives the rope the desired buoyancy.

It is reported that a geological survey party has discovered extensive deposits of nickel and iron ores near Maikop in the Caucasus.

Operators handling paraffin-base crudes often experience much difficulty, in cold weather, with deposits of paraffin in lead lines from oil wells to storage tanks. To overcome this, an oil company in the Southwest has conceived the idea of feeding calcium carbide—in lumps of the size known as "quarter"—together with a little water into the choked line. In reacting, the carbide and the water generate heat enough to melt the paraffin, which is then picked up by the oil and carried on through and out of the line. It is said that heavy deposits of paraffin in lines a quarter of a mile long have been successfully removed by this method.

The world's fleet of oil tankers of 500 tons and more now numbers 961 vessels. Of these, 391 fly the American flag—the largest flotilla of its kind owned by any one nation. Ten per cent. of the tankers in service have Diesel engines.

A commission appointed by the Italian Government has just completed plans for the construction of a subway in Rome. The project calls for a number of lines, having a total length of 27 miles, radiating from a common center to all sections of the city.

A concrete skyscraper that will surpass in height New York City's famous Woolworth Building is now in course of construction in Detroit, Mich. The structure will be 873 feet high, and 4 of its 85 floors will be below ground level.

Approximately 71 per cent. of the population of the United States, or 83,000,000 people, now use electric light.

The airplane service of the United States Post Office Department is steadily increasing its facilities. At the present time, 29 States and the District of Columbia are traversed by air-mail 'planes.

In the Metropolitan Theater, Boston, Mass., has been installed a cooling system that will maintain a temperature of 70° F., in the auditorium both winter and summer. The plant consists in the main of two refrigerating compressors. These are used to chill water which, in turn, cools the ventilating air.

Storage-battery manufacturers in the United States used 180,000 tons of lead in 1925. This is interesting in view of the fact that there was hardly any call for this material for that purpose a few years ago.

According to figures given out by the National Bureau of Economic Research, the total population of the United States on January 1, 1926, was 115,940,000—an increase of 1,629,000 in a twelvemonth.

Tennis players will be interested in the announcement that courts of limestone are much more resilient than clay courts and enable players to attain a faster game. Courts of this description have been built for the University of Cincinnati.

Surveys made by Stone & Webster, Inc., indicate that the farm power bill is greater than that of any other industry in the United States —being about $3,000,000,000 per year. The figures show that of all the sources of power, animal power is the most expensive—costing about 24 cents per horse-power hour—while electricity is perhaps the cheapest. The cost of electricity varies of course with local conditions, but the average is about 5 cents per horse-power hour.

Twenty-four nations were represented in the traffic through the Panama Canal during the year ended June 30, 1926. Vessels of United States registry led, with 2,432 transits, or 50.7 per cent. of the aggregate net tonnage. Ships of British registry were second, with 1,423 transits; Norwegian ships came third, with 306 transits; and German ships were fourth, with 163 transit.

You can take it for what it is worth, but *Die Post* is responsible for the following statement as to the origin of the picture postcard: "A German student, while dining with a friend in a café, spilled some coffee, a few drops of which fell on an ordinary postcard that happened to be lying on the table. His companion, using a toothpick, transformed the coffee into an amusing drawing. An enterprising printer had an engraving made of the picture, which, reproduced on postcards, was soon widely circulated."